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THE Society met on the 14th of March, 1855, on which occasion the following Paper was read.

ON LOCALITIES OF FOSSILS OF THE CARBONIFEROUS LIMESTONE OF IRELAND. BY JOHN KELLY, ESQ.

THE carboniferous limestone is perhaps the best developed and the best defined of the rocks of our island. The formation of which the limestone forms a part has a line or junction of sedimentary unconformability at its base, and another at the top, where the New Red Sandstone overlies it. In the Carboniferous formation, between those two junctions, all the beds are parallel to each other, or in one bundle, if I may so term it. Since, therefore, there is such an opportunity, it appears incumbent on our Geological Society to furnish a good account of this division of the formation, toward which I hope the present paper will be of use.

Many of the members of this Society are aware that the fossils of the carboniferous limestone of Ireland, including the slates which lie beneath it, and form a part of the formation, have been described by Mr. Frederick M'Coy, late Professor of Geology at the Queen's College, Belfast; and a Synopsis of them printed at the instance of Mr. Griffith in 1844; but all will see with regret that the usual practice in all such works has been departed from in this case, and that no locality is given in that book for any one fossil.

As this Synopsis is now the most complete descriptive account of our Irish carboniferous limestone fossils, and is likely to continue so for some time, this paper is brought forward as an accompaniment to it, and to leave on record the different localities in which the fossils so described have been found, so that those localities may not be forgotten or lost.

In considering how this should be done, it appears to me that a general Table is the most eligible form; this to consist of a list of the names of all the fossils in the Synopsis; the authority for the original name and description; the mineral character of the rock in which any fossil occurs; and a few* of the chief localities whence each was obtained.

After this Table will be an alphabetical list of all the localities in which fossils were found, amounting in number to about two hundred and eighty; giving the name of the place, with a short description of the quarry or ravine in which the fossils occur, and its bearing and distance from the nearest post-town. Thus a person, having even a temporary residence in any town, may know the places of interest regarding fossils in his vicinity, and make further search, where a first and perhaps imperfect trial has been made before.

As Mr. M'Coy has changed the names of many of the old genera, and divided others, I deem it necessary to give the old names, which is done by means of letters of reference, and corresponding marginal notes.

In the Carboniferous formation there are four kinds of rocks, distinct in mineral character; the lowest or first division of these is—.

1. Old Red Sandstone.
2. Calcareous slate.
3. Limestone.
4. Coal-measures, being chiefly argillaceous shales and slates, with some sandstones and ironstones.

Some of the fossils of the formation are found in sandstone, and not in any other of these divisions; some are peculiar to the calcareous slate; some to limestone; and some are found only in the black mud deposits or slates of the coal measures. Again, some of the fossils are common to two of those mineral divisions, and some are found in three of them. The molluscous fossils of the Old Red Sandstone are very few and scarce, being mostly casts, and are in general not found in any other division.

For these reasons I have thought it advisable to classify the fossils according to the mineral character of the beds in which they are found, and I have, therefore, put in the Table four small columns to suit the four subdivisions above-named.

At Benburb, in the county of Armagh, in the cutting for the Lough Erne and Lough Neagh Canal, a section is visible in which sandstones, limestones, and calcareous slates, three or four bands of each, are interstratified with one another, in about a quarter of a mile of distance, all dipping westward at an angle of about 20°; and facts of this nature are not unusual in the north of Ireland. In all such cases, the fossil, found in a limestone band, I have put into the column for limestone; every fossil got in calcareous slate is marked in the slate column; and those found in sandstone are entered in the column for that rock, and so also with the molluscous fossils of the coal series.

The millstone grit and coal-measures I have included in one mineral subdivision or column; because those two in Ireland are conformable and alike. I do not know how many feet above the limestone the millstone grit ends, or the coal-measures begin. There does not appear in this country any good reason for these distinctions.

The plants of the coal-measures are not included in the Table. No good collection of them from Irish collieries has been described. Many fine specimens of undescribed plants were got at Dromagh colliery, near Kanturk, in the county of Cork, in 1842, but Mr. M'Coy did not describe any new plants in the Synopsis.

Opposite the name of every fossil a star is put in the column, representing the mineral subdivision in which it was found; where a fossil has been got in two or three of those subdivisions, a star is put in the proper column in each case, to represent it.

Where two stars are marked in one column and one in another, they show that the fossil is more abundant in the division marked with two stars than in the other; and where three are marked in one column, they show that the fossil has been found in three localities at least, in that subdivision, and not in any other, or that the fossil is peculiar to that mineral subdivision.

The names of localities in general are the townland names on the Ordnance maps: but in a few cases, deviations are made from this rule; for instance, Malahide is given as one locality, although it includes the whole shore from Portmarnock Martello Tower to the village of Malahide, which comprises part of several townlands; but these deviations are explained in every case in the detailed description of the locality.

Where two or three localities are given for a fossil, the first name represents the lowest mineral subdivision, and the last name refers to the highest in geological sequence.

Where a fossil was found in several different places, say thirty for instance, for want of room in the Table only three of the principal localities are given; but as, in addition, it was got in twenty-seven other localities, this figure is put in the last column, headed, "Other Localities." The object of this is to show the abundance of a particular fossil in the formation.

To make the Table more complete for Ireland I have introduced into the list made from the Synopsis such fossils of the Carboniferous formation as were described by Colonel Portlock, and not found by Mr. Griffith's collectors; also, any described as from Ireland by Phillips, Sowerby, Austen, or any other, so far as I know. The Table, therefore, contains all the fossils published of this formation.

The English geologists often give a parish, a county, or Ireland as the locality of a fossil; some of those are therefore unsatisfactory for my purpose, and not knowing what mineral column to put them into, I have therefore omitted to put them in any.

The whole number of fossils named in the Table is 1050. Of these, in the order of time, are first described by—

Sowerby, in Mineral Conchology,		62
Phillips, Geology of York,	255	364
Phillips, Palæozoic Fossils,	109	
Fleming, British Animals,		9
Agassiz, Poissons Fossiles,		46
Portlock, in Geological Report,		80
M'Coy, in Synopsis,		442
Austen, in Annals of Natural History,		27
Others, a few each,		20
Total,		1050

The total number of fossils described in the Synopsis by M'Coy is 893, of which 442, or about one half, are new to science, not having been described before.

EXPLANATION OF ABBREVIATIONS IN THE COLUMN OF AUTHORITIES.

Ag.	Agassiz, Poissons Fossiles.
Aus. A. N. H. . . .	Austen, Annals of Natural History.
Aus. M. Cr.	Austen, Monograph of Crinoidea.
Bronn, ...	Bronn, Lethea Geognostica.
Buck.	Buckland's Bridgewater Treatise.
Flem. A. P.	Fleming, Annals of Philosophy.
Flem. B. A.	Fleming, British Animals.
Gold.	Goldfuss, Petrefacten.
Kon.	Koninck, Description des Animaux Fossiles.
Lam.	Lamarck, Animaux sans Vertebre.
Lons.	Lonsdale.
Mart.	Martin, Petrifacta Derbiensia.
M'C.	M'Coy, Synopsis.
M'C. A. N. H. . . .	M'Coy, Annals of Natural History.
Mill.	Miller's Crinoidea.
Mün.	Münster.
Phil. G. Y.	Phillips' Geology of York.
Phil. P. F.	Phillips' Palæozoic Fossils.
Port.	Portlock's Geological Report.
Schlot.	Schlotheim Pet.
Sco.	Scouler, MSS.
Sow. G. T.	Sowerby, Geological Transactions.
Sow. M. C.	Sowerby, Mineral Conchology.
Sow. S. S.	Sowerby, Silurian System.
Sow. Z. J.	Sowerby, Zoological Journal.
Ver. B. S. G. F., . .	De Verneuil, Bulletin Societé Geologique de France.

EXPLANATION OF ABBREVIATIONS IN THE COLUMNS FOR MINERAL CHARACTER.

O. R. S.	Old Red Sandstone.
Cal. Sl.	Calcareous Slate.
Limest.	Limestone.
Coal.	Coal series.

I may remark here, that I use the term Calcareous Slate in preference to Carboniferous Slate,—a name recently given to this subdivision of the formation, because all the slates in the whole formation are carboniferous slates: and those slates above the main body of the limestone, in the coal-measures, are more eminently carboniferous than the slates which lie below it, that is, those in question, which are eminently calcareous in their nature, and generally interstratified with thin beds of limestone.

SYNOPTICAL TABLE.—LIST OF FOSSILS AND LOCALITIES.

NAME.	AUTHORITY.	O. R. S.	Cal. Sl.	Limest.	Coal.	LOCALITIES.	Other localities.
PISCES.							
Asteroptychius ornatus.	Ag. 3.	.	.	*	.	Armagh.	
„ Portlocki.	Ag. 3.	.	.	*	.	Armagh.	
Charcharopsis prototypus.	Ag. 3.	.	.	*	.	Armagh.	
Chomatodus cinctus.	Port. xiv. A. 9.	.	.	*	.	Armagh.	
„ linearis.	Port. xiv. 8.	.	.	*	.	Armagh.	
„ truncatus.	Ag. 3.	.	.	*	.	Armagh.	
Cladodus acutus.	Ag. 3. Port.	.	.	*	.	Armagh.	
„ basalis.	Ag. 3. Port.	.	.	*	.	Armagh.	
„ marginatus.	Ag. 3.	.	.	*	.	Armagh.	
„ mirabilis.	Ag. 3.	.	.	*	.	Armagh.	
„ striatus.	Ag. 3.	.	.	*	.	Armagh.	
Cochliodus acutus.	Ag. 3.	.	.	*	.	Armagh.	
„ contortus.	Ag. 3 14. 16.	.	.	*	.	Armagh.	
„ magnus.	Port. xiv. A. 4.	.	.	*	.	Armagh.	
„ oblongus.	Port. xiv. A. 5. 10.	.	.	*	.	Armagh.	
„ striatus.	Ag. 3.	.	.	*	.	Armagh.	
Cricacanthus Jonesii.	Ag. 3.	.	.	*	.	Armagh.	
Ctenacanthus arcuatus.	Ag. 3.	.	.	*	.	Armagh.	
„ crenulatus.	Ag. 3.	.	.	*	.	Armagh.	
„ heterogyrus.	Ag. 3.	.	.	*	.	Armagh.	
Ctenoptychius macrodus.	Port. xiv. 7.	.	.	**	.	Armagh, Carnteel.	
„ dentatus.	Ag. 3.	.	.	*	.	Armagh.	
„ marginalis.	Ag. 3.	.	.	*	.	Armagh.	
„ radicans.	Ag.	.	.	*	.	Armagh.	
„ serratus.	Ag. 3.	.	.	*	.	Armagh.	
Gyracanthus formosus.	Ag. 3; 1, 8.	.	*	.	.	Moyola River.	
„ tuberculatus.	Port. xiii. 14, 15.	.	*	.	.	Moyola River.	
Helodus didymus.	Ag. 3.	.	.	*	.	Armagh.	
„ lævissimus.	Ag. 3; 14, 1-15.	.	.	*	.	Armagh.	
„ mamillaris.	Ag. 3.	.	.	*	.	Armagh.	
„ planus.	Ag. 3.	.	.	*	.	Armagh.	
„ turgidus.	Ag. 3; 15, 1-12.	.	.	**	.	Armagh. Templecarn.	
Holoptychius Hibbertii.	Port. xiv. A. 12.	.	**	.	.	Cultra, Moyheeland.	
„ Portlockii.	Port. xiii.	.	**	.	.	Moyola River, Fallagloon.	
Leptacanthus priscus.	Ag. 3.	.	.	*	.	Armagh.	
Onchus falcatus.	Ag. 3.	.	.	*	.	Armagh.	
„ plicatus.	Ag. 3.	.	.	*	.	Armagh.	
„ rectus.	Ag. 3.	.	.	*	.	Armagh.	
Oracanthus confluens	Ag. 3.	.	.	*	.	Armagh.	
„ minor.	Ag. 3; 3-5, 6.	.	.	*	.	Armagh.	
Orodus angustus.	Ag.	.	.	*	.	Armagh.	
„ catenatus.	Ag.	.	.	*	.	Armagh.	
„ cinctus.	Ag. 3; 11. 1-4.	.	.	*	.	Cork.	
„ gibbus.	Ag.	.	.	*	.	Armagh.	
„ ramosus.	Port. xiv. A. 8.	.	.	**	.	Hook Point, Cork.	
Paleoniscus Egertoni.	Port. xiv. 1.	.	*	.	.	Drumkeeran.	
„ Robisoni.	Port. xiv. A. 13, 15.	.	*	.	.	Enniskillen.	
Petalodus Hastingsæ.	Port. xiv. 10.	.	.	**	.	Armagh, Clogher.	
„ lævissimus.	Ag. 3.	.	.	*	.	Armagh.	
„ marginalis.	Ag. 3.	.	.	*	.	Armagh.	
„ psittacinus.	Ag.	.	.	*	.	Armagh.	
„ radicans.	Ag. 3.	.	.	*	.	Armagh.	
„ rectus.	Port. xiv. 9.	.	*	*	.	Bundoran, Armagh.	
„ sagittatus.	Ag. 3.	.	.	*	.	Armagh.	
Ptysonemus subteres.	Ag. 3.	.	.	*	.	Armagh.	
Pœcilodus Jonesi.	Port. xiv. A. 6.	.	.	*	.	Armagh.	
„ obliquus.	Ag. 3.	.	.	*	.	Armagh.	
„ parallelus.	Ag. 3.	.	.	*	.	Armagh.	
„ sublævis.	Ag. 3.	.	.	*	.	Armagh.	
„ transversus.	Port. xiv. A. 7.	.	.	*	.	Armagh.	
Psammodus cornutus.	Port. xiv. A. 3.	.	*	*	.	Armagh.	
„ porosus.	Port. xiv. A. 1.	.	.	***	.	Armagh, Derryloran, Desertmartin.	
„ rugosus.	Ag. 3, 12-14.	.	.	**	.	Armagh, Carnteel.	
Tristychius minor.	Port. xiv. 6.	.	*	.	.	Drumkeeran.	

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
CEPHALOPODA.							
Orthoceras attenuatum.	Flem. A. P.	.	**	*	.	Fallagloon, Bundoran, Rathgillen.	6
„ cinctum.	Sow. M. C.	.	.	*	**	Rathgillen, Ballintree, Cahenanalt.	
„ cylindraceum.	Flem. A. P.	.	.	***	.	Rathcline, Curkeen, Tankardstown.	4
„ filiferum.	Phil. G. Y.	.	*	.	**	Lisnapaste, Culkagh, Carrownanalt.	
„ inequiseptum.	Phil. G. Y.	.	.	.	*	Carrownanalt.	
„ mucronatum.	M'C. i. 1.	.	.	.	*	Miltown Malbay.	
„ ovale.	Phil. G. Y.	.	.	***	.	Rathgillen, Ardclogh, Armagh.	
„ pyramidale.	Flem. A. P.	.	*	**	.	Larganmore, Millecent, Doneraile.	
„ Steinhaueri.	Phil. G. Y.	.	*	.	*	Lisnapaste. Cahirush.	
„ striatum.	Sow. M. C.	.	.	**	.	Carrigahorig, Little Island.	
„ sulcatulum.	M'C. i. 4.	.	.	.	*	Culkagh.	
Loxoceras[a] Breynii.	Sow. M. C.	.	.	***	.	Millecent, Streamhill, Little Island.	
„ distans.	M'C. iv. 1.	.	.	*	.	Kilmallock.	
„ incomitatum.	M'C. i. 6.	.	.	.	.	Cove or Queenstown.	
„ laterale.	Phil. G. Y	.	*	**	*	Lisnapaste, Millecent, Little Island, Carrownanalt.	9
Trigonoceras[b] paradoxicum.	Sow. M. C.	.	.	*	.	Millecent.	
Campyloceras[c] arcuatum.	Phil. G. Y.	.	.	*	.	Blacklion.	
„ unguis.	Phil. G. Y.	.	.	*	.	Little Island.	
Cycloceras[d] annularis.	Flem. A. P.	.	.	*	.	Tornaroan.	
„ lævigatum.	M'C. i. 3.	.	.	*	.	Shrule.	
„ lineolatum.	Phil. P. F.	.	.	*	.	Doneraile.	
Poterioceras[e] fusiforme.	Phil. G. Y.	.	.	*	.	Millecent.	
„ ventricosum.	M'C. i. 2.	.	.	*	.	Millecent.	
Actinoceras[f] giganteum.	Sow. M. C.	.	.	***	.	Castle Espie, Armagh, Millecent.	
„ pyramidatum.	M'C. i. 5.	.	.	*	.	Castle Espie.	
Cyrtoceras tuberculatum.	M'C. iv. 2.	.	*	*	.	Bundoran, Cork.	
Phragmoceras flexistria.	M'C. i. 7.	.	*	.	.	Killycloghy.	
NAUTILIDÆ.							
Goniatites Browni.	M'C. iv. 17.	.	.	*	.	Cork.	
„ crenistria.	Phil. G. Y.	.	*	.	.	Lisnapaste.	
„ discus.	M'C. ii. 6.	.	.	*	.	Cork.	
„ excavatus.	Phil. P. F.	.	*	**	.	Lisnapaste, Ballyduff, Blacklion.	
„ fasciculatus.	M'C. ii. 8.	.	.	*	.	Millecent. [rownanalt.	
„ Gibsoni.	Phil. G. Y.	.	*	.	**	Ballinacourty, Paget Priory, Car-	
„ Gilbertsoni.	Phil. G. Y.	.	.	.	*	Carrownanalt.	
„ granosus.	Port. 29–9.	.	*	.	.	Tyrone.	
„ intercostalis.	Phil. G. Y.	.	**	.	.	Killyrean Upper, Crosspatrick.	
„ latus.	M'C. ii. 7.	.	.	*	.	Millecent. [nalt.	
„ Listeri.	Phil. G. Y.	.	.	**	*	Carrickahorig, Millecent, Carrowna-	
„ micronotus.	Phil. G. Y.	.	*	.	.	Ballinacourty.	
„ mutabilis.	Phil. G. Y.	.	.	*	.	Cregg.	
„ obtusus.	Phil. G. Y.	.	.	***	.	Cregg, Millecent, Ballyduff.	
„ reticulatus.	Phil. G. Y.	.	**	.	.	Mullaghtinny, Lisnapaste.	
„ rotiformis.	Phil. G. Y.	.	.	.	*	Kulkeagh.	
„ serpentinus.	Phil. G. Y.	.	.	.	*	Carrownanalt.	
„ sphæricus.	Phil. G. Y.	.	.	.	.	Kildare (Morris).	
„ sphæroidalis.	M'C. iv. 18.	.	.	**	.	Nenagh, Kilmallock.	
„ spiralis.	Phil. P. F.	.	.	.	*	Ballintree.	
„ striatus.	Phil. G. Y.	.	.	*	.	Drumscraw. [nalt.	
„ striolatus.	Phil. G. Y.	.	*	*	*	Mullaghtinny, Blacklion, Carrowna-	
„ truncatus	Phil. G. Y.	.	.	**	.	Millecent, Tankardstown.	
„ vesica.	Phil. G. Y.	.	.	.	.	Kulkeagh.	
„ Vittiger.	Phil. G. Y.	.	.	.	*	Carrownanalt.	
Clymenia plurisepta.	Phil. P. F.	.	*	.	.	Bruckless.	
„ sagittalis.	Phil. P. F.	.	*	.	.	Bruckless.	
Discites[g] costellatus.	M'C. ii. 4.	.	.	*	.	Millecent.	
„ discors.	M'C. iii. 5.	.	.	**	.	Millecent, Cork.	
„ latidorsatus.	M'C. iv. 16.	.	.	**	.	Millecent, Cork.	
„ Luidii.	Mart. Derb.	.	.	.	*	Carrownanalt.	
„ mutabilis.	M'C. iii. 7.	.	.	***	.	Armagh, St. Doulough's, Cork.	
„ oxystomus.	Phil. G. Y.	.	.	*	.	Drumscraw.	

[a] Loxoceras, was Orthoceras. [b] Trigonoceras, was Orthoceras. [c] Campyloceras, was Orthoceras.
[d] Cycloceras, was Orthoceras. [e] Poterioceras, was Orthoceras. [f] Actinoceras, was Orthoceras.
[g] The Discites of M'Coy is the Nautilus of other writers.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
NAUTILIDÆ—*continued.*							
Discites planotergatus.	M'C. ii. 2.	.	.	*	.	Little Island.	
„ subsulcatus.	Phil. G. Y.	.	.	**	.	Millecent, Little Island.	
„ sulcatus.	Phil. G. Y. / M'C. iv. 14.	.	**	*	.	Ring, Mullaghfarry, Little Island.	3
„ tetragonus.	Phil. G. Y.	.	**	*	.	Lisnapaste, Bruckless, Blacklion.	
„ trochlea.	M'C. iii. 4.	.	.	*	.	Cookstown.	
Temnocheilus[a] biangulatus.	Phil. G. Y.	.	*	**	.	Ballinacourty, Millecent, Middleton.	5
„ bistrialis.	Phil. G. Y.	.	.	*	.	Blacklion.	
„ cariniferus.	Phil. G. Y.	.	.	***	.	Tirlicken, Millecent, Ardclogh.	
„ coronatus.	M'C. iv. 15.	.	.	*	.	Little Island.	
„ costalis.	Phil. G. Y.	.	.	*	.	Millecent.	
„ carinatus.	M'C. ii. 9.	.	.	*	.	Tirlicken.	
„ furcatus.	M'C. iv. 13.	.	*	**	.	Crevenish, Castlerickard, Middleton.	
„ globatus.	Sow. M. C.	.	.	**	.	Cork, Fortwilliam.	
„ multicarinatus.	Sow. M. C.	.	.	***	.	Tirlicken, Millecent, Little Island.	
„ pinguis.	M'C. iv. 12.	.	.	**	.	Kilmallock, Ballyduff.	
„ porcatus.	M'C. iii. 6.	.	.	*	.	Killeshandra.	
„ sulciferus.	Phil. G. Y.	.	.	***	.	Rathcline, Millecent, Ardclogh.	
„ tuberculatus.	Phil. G. Y.	.	*	.	.	Kilbride.	
Nautilus cyclostomus.	Phil. G. Y.	.	.	***	.	Millecent, Little Island, Blacklion.	
„ dorsalis.	Phil. G. Y.	.	.	***	.	Millecent, Little Island, Kilcommock.	
„ goniolobus.	Phil. G. Y.	.	*	.	.	Mullaghtinny.	
„ planidorsatus.	Port. 35. 1.	.	.	*	.	Derryloran.	
Bellerophon apertus.	Phil. G. Y.	.	.	***	.	Ballinglen, Carlingford, Ardclogh.	11
„ cornu arietis.	Phil. G. Y.	.	.	**	.	Magherenny, Armagh.	
„ costatus.	Phil. G. Y.	.	.	***	.	Cookstown, Carlingford, Ardagh.	
„ decussatus.	Port. 29. 6.	.	*	.	.	Tyrone	
„ hiulcus.	Phil. G. Y.	.	*	**	.	Killaghtee, Ballinglen, Ardclogh.	
„ lævis.	M'C. ii. 1.	.	.	*	.	Millecent.	
„ obsoletus.	M'C. ii. 3.	.	.	*	.	Millecent.	
„ reticulatus.	M'C. ii. 5.	.	.	*	.	Tornaroan.	
„ striatus.	Port. 29. 7.	.	*	.	.	Tyrone.	
„ tangentialis.	Phil. G. Y.	.	.	***	.	Carlingford, Ardagh, Millecent.	
„ tenuifascia.	Phil. G. Y.	.	.	***	.	Ardagh, Millecent, Curkeen.	
„ Wenlockensis.	Phil. P. F.	.	.	*	.	Ballinglen.	
Euphemus[b] globatus.	Phil. P. F.	.	.	*	.	Derryloran.	
„ orbiculus.	Not figured.	.	.	*	.	Locality lost.	
„ intersectus.	M'C. iii. 10.	.	.	*	.	Cookstown.	
„ urii.	Phil. G. Y.	.	*	**	.	Mullaghtinny, Tornaroan, Cooks-[town.	
PTEROPODA.							
Conularia quadrisulcata.	Sow. M. C.	.	.	.	*	Locality lost.	
GASTEROPODA.							
Macrocheilus[c] acutus.	Phil. G. Y.	.	.	**	.	Millecent, Laracor.	
„ canaliculatus.	M'C. v. 1.	*	.	.	.	Kilcummin.	
„ curvilineus.	Phil. G. Y.	.	*	*	.	Bruckless, Millecent.	
„ imbricatus.	Phil. G. Y.	.	.	*	.	Millecent.	
„ fimbriatus.	M'C. v. 2.	.	*	.	.	Dromard.	
„ ovalis.	M'C. v. 3.	.	*	.	.	Bruckless.	
„ parallelus.	Phil. G. Y.	.	.	*	.	Armagh.	
„ percinctus.	Port. 31. 10.	.	.	*	.	Derryloran.	
„ rectilineus.	Phil. G. Y.	.	.	**	.	Drumlattery, Little Island.	
„ sigmilineus.	Phil. G. Y.	.	.	*	.	Kildare.	
„ tricinctus.	M'C. v. 4.	.	.	.	.	Locality lost. Ireland (Morris).	
Loxonema[d] brevis.	M'C. iii. 2.	.	.	*	.	Toberory.	
„ constricta.	Phil. G. Y.	.	.	***	.	St. John's Point, Ballinglen, Mille-[cent.	
„ impendens.	M'C. iii. 3.	.	*	*	.	Mullaghtinny, Chicken-hill.	
„ polygyra.	M'C. iii. 1.	.	**	*	.	Cullion, Mullaghtinny, Curkeen.	
„ pulcherrima.	M'C. vii. 7.	.	.	*	.	Lackagh.	
„ sulcatula.	M'C. i. 6.	.	*	.	.	Carrigoughter.	
„ sulculosa.	Phil. G. Y.	.	*	**	.	Bundoran, Millecent, Tankardstown.	
„ tenuistriata.	Port. 31. 4.	.	*	.	.	Aghalurcher, Co. Tyrone.	

[a] Temnocheilus of M'Coy, was Nautilus.
[b] Euphemus, was Bellerophon.
[c] Macrocheilus, was Buccinum.
[d] Loxonema, was Melania.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
GASTEROPODA—*continued.*							
Loxonema tumida.	Phil. P. F.	.	*	*	.	Bruckless, Tirlicken.	
„ turrita.	M'C. v. 7.	.	.	*	.	Cookstown.	
Turritella megaspira.	M'C. v. 5.	.	.	*	.	Millecent.	
„ suturalis.	Phil. G. Y.	.	.	***	.	Cookstown, Blacklion, Carrigahorig.	
„ tenuistria.	Phil. G. Y.	.	.	***	.	Tirlicken, Horath, Oldtown.	
Turbo spirata.	M'C. v. 29.	.	.	*	.	Killalla.	
Littorina pusilla.	M'C. v. 26.	.	.	*	.	Blacklion.	
Lacuna antiqua.	M'C. v. 24.	.	**	.	.	Corlave, Kilcummin.	
Natica ampliata.	Phil. G. Y.	.	.	.	.	Ireland.	
Naticopsis canaliculata.	M'C. vii. 3.	.	*	.	.	Ring.	
„ dubia.	M'C. vii. 2, *2a.*	.	.	**	.	Carrigahorig, Carrigaline.	
„ elongata[a].	Phil. G. Y.	.	.	***	.	Castle Espie, Kiltullagh, Millecent.	
„ neritoides.	M'C. v. 25.	.	.	*	.	Tullyoran.	
„ Phillipsii.	M'C. iii. 9.	.	.	***	.	Millecent, Lane, Chickenhill.	5
„ plicistria.	Phil. G. Y.	.	.	***	.	Cookstown, College-hall, Millecent.	4
„ spirata[b].	Sow. M. C.	.	*	**	.	Donegal, Blacklion, Horath.	
Phanerotinus nudus.	Sow M. C.	.	.	.	.	Ireland.	
Euomphalus[c] acutus.	Phil. G. Y.	.	*	**		Larganmore, Armagh, Little Island.	9
„ anguis.	M'C. iii. 11.	.	.	*	.	Chickenhill.	
„ æqualis[d].	Sow. M. C.	.	*	**	.	Malahide, Ballykea, Curkeen.	
„ bifrons.	Phil. G. Y.	.	*	**	.	Bruckless, Millecent, Tankardstown.	
„ calyx.	Phil. G. Y.	.	*	**	.	Bruckless, Millecent, Tankardstown.	
„ catillus.	Phil. G. Y.	.	*	**	.	Granard, Horath, Millecent.	
„ cristatus.	Phil. G. Y.	.	.	*	.	Roscommon.	
„ colei.	Sow. M. C.	.	.	.	.	Ireland.	
„ crotalostomus.	M'C. vii. 4.	.	*	**	.	Finner, Rathmoyle, Drum.	
„ elongatus.	M'C. iii. 12.	.	.	*	.	Ballinglen.	
„ marginatus.	M'C. v. 21.	.	*	*	.	Malahide, Balsitric.	
„ neglectus.	M'C. v. 23.	.	.	*	.	Millecent.	
„ pentangulatus.	Phil. G. Y.	.	*	**	.	Bruckless, Millecent, Carrigahorig.	22
„ pileopsideus.	Phil. G. Y.	.	.	**	.	Ardagh, Howth.	
„ quadratus.	M'C. v. 22.	.	*	.	.	Mullaghtinny.	
„ rotundatus.	Phil. G. Y.	.	.	***	.	Ballinglen, Ballykea, Millecent.	7
„ serpens.	Phil. P. F.	.	*	**	.	Lisnapaste, Oldtown, Howth.	5
„ tabulatus.	Phil. G. Y.	.	*	**	.	Malahide, Tirlicken, Little Island.	7
„ tuberculatus[e].	Flem. p. 313.	.	.	*	.	Ireland.	
Ampullaria nobilis.	Sow. M. C.	.	.	*	.	Cork.	
Platychisma cirroidea.	M'C. vi. 2.	.	.	*	.	College Hall.	
„ helicoides[f].	Phil.	.	.	***	.	Millecent, Curkeen, Cookstown.	
„ Jamesii.	M'C. v. 20.	.	.	*	.	Donaghrisk.	
„ zonites.	M'C. v. 17.	.	.	*	.	Cork.	
Pleurotomaria altavittata.	M'C. v. 11.	.	*	.	.	Drumgowna.	
„ canaliculata.	M'C. vi. 3*a*, *b*.	.	**	*	.	Doorin, Carrowmably, St. John's Point.	
„ carinata.	Phil. G. Y.	.	.	*	.	Cookstown.	
„ clathrata.	M'C. v. 12.	.	*	.	.	Malahide.	
„ concentrica.	Phil. G. Y.		*	**	.	Ring, Cregg, Milverton.	
„ conica.	Phil. G. Y.	.	*	.	.	Donegal.	
„ decussata.	M'C. v. 13.	.	.	*	.	Millecent.	
„ filosa.	M'C. v. 14.	.	.	**	.	Curkeen, Millecent.	
„ Griffithii.	M'C. vi. 1.	.	.	**	.	Ardclogh, Millecent.	
„ Hainesii.	M'C. iii. 8.	.	.	*	.	Cork.	
„ helicinoides.	M'C. vii. 6.	.	.	*	.	Little Island.	
„ lævis.	M'C. v. 15.	.	.	*	.	Ballygasey.	
„ lenticula.	M'C. vii. 5.	.	.	*		Little Island.	
„ multicarinata.	M'C. v. 16.	.	.	**	.	Millecent, Little Island.	
„ tornatilis.	Phil. G. Y. M'C. vii. 5, *5a.*	.	*	.	.	Lisnapaste.	
Murchisonia elongata.	Port. 38. 10.	.	**	.	.	Dromard, *common*, Cullion.	
„ Larcomi.	M'C. v. 8.	.	*	.	.	Leam.	
„ quadricarinata.	M'C. v. 9.	.	.	*	.	Blacklion.	
„ sulcata.	M'C. v. 10.	.	*	.	.	Cullion.	
Elenchus antiquus.	M'C. v. 18.	.	*	.	.	Bruckless.	
„ subulatus.	M'C. v. 19.	.	.	*	.	Armagh.	

[a] Naticopsis, was Natica. [b] Naticopsis, was also Nerita. [c] Euomphalus, was Cirrus.
[d] Euomphalus æqualis, was Planorbis. [e] Euomphalus, was Delphinula. [f] Platychisma, was Ampullaria.

NAME.	AUTHORITY.	O. R. S.	Cal. Sl.	Limest.	Coal.	LOCALITIES.	Other localities.
SCUTIBRANCHIA AND CYCLOBRANCHIA.							
Trochella prisca.	M'C. vii. 1.	.	.	*	.	Millecent.	
Fissurella elongata.	M'C. v. 27.	.	*	.	.	Lisnapaste.	
Dirinus Bucklandi.	M'C. v. 28.	.	*	.	.	Manorhamilton.	
Acroculia[a] angustata.	Phil. G. Y.	.	.	*	.	Clare.	
,, canaliculata.	M'C. iii. 13.	.	.	*	.	Toberory.	
,, carinata.	No figure. D'Archiac, &c.	.	*	*	.	Ballinacourty, Millecent.	
,, sigmoidalis.	Phil. P. F.	.	*	.	.	Bruckless.	
,, striata.	Phil. G. Y.	.	.	*		Kildare.	
,, triloba[a].	Phil. G. Y.	.	**	*	.	Malahide, Hook, Chickenhill.	
,, tubifer[a].	Phil. G. Y.	.	*	.	.	Hook.	
,, vetusta.	Phil. P. F.	.	*	**	.	Hook, Millecent, Little Island.	
Patella mucronata.	Phil. G. Y.	.	*	*	*	Bruckless, Cookstown, Carrownanalt.	
,, scutiformis.	Phil. G. Y.	.	.	**	.	Lackagh, Tralee.	
,, sinuosa.	Phil. G. Y.	.	*	*	.	Bundoran, Millecent.	
Siphonaria Konincki.	M'C. iii. 14.	.	.	*	.	Ballymacelligot.	
Umbrella lævigata.	M'C. v. 31.	.	.	*	.	Millecent.	
Dentalium inornatum.	M'C. v. 30.	.	.	*	*	Cookstown, Carrownanalt.	
DITHYRA.							
Teredo antiqua.	M'C. viii. 1.	.	*	.	.	Fasglassagh.	
Solenopsis[b] minor.	Port. 36-4. M'C. viii.2.	.	.	*	.	Drumreagh.	
Sanguinolites[c] angustatus.	Phil. G. Y.	.	**	.	*	Lisnapaste, Poulscadden, Glenbane.	3
,, arcuatus.	Phil. G. Y.	.	*	*	.	Ring, Millicent.	
,, attenuata.	Port. 36. 3.	*	.	.	.	Tyrone.	
,, contortus.	M'C. xix. 3.	.	.	*	.	Chickenhill.	
,, costellatus.	M'C. viii. 5.	.	*	.	.	Killycloghy.	
,, curtus.	M'C. xi. 1.	.	*	.	.	Manorhamilton.	
,, discors.	M'C. viii. 4.	*	.	.	.	Bruckless, in yellow sandstone.	
,, gibbosa.	Sow. M. C.	.	*	*	*	Lisnapaste, Roughan, Glenbane.	
,, iridinoides.	M'C. xii. 1.	.	.	.	.	Locality lost.	
,, liratus.	Phil. P. F.	.	.	.	.	Ireland.	
,, maxima.	Port. 36. 1.	.	.	*	.	Tyrone.	
,, oblonga.	Port. 36. 2.	.	.	*	.	Tyrone.	
,, plicatus.	M'C. x. 3*a*, 3*b*. Port. 34. 18.	.	**	.	*	Bruckless, Ballintrillick, Glenbane.	
		.	*	.	.	Benburb.	
,, radiatus.	M'C. xiii. 4.	.	.	*	.	Killymeal. [bane.	
,, sulcatus.	Phil. G. Y.	*	*	*	*	Hook, Ballinglen, Cookstown, Glen-	3
,, transversus.	Port. 34. 21.	.	*	.	.	Bunatrahir, Kilcummin.	
,, tricostatus.	Port.	.	**	*	.	Ballybodonnell, Bundoran, Killalla.	
,, tumidus.	Phil. G. Y.	.	*	**	.	Larganmore, Millecent, Carrigoline.	
,, undatus.	Port. 34. 20.	.	***	.	.	Boa Island, Ballintrillick, Mullagh-	3
Solemyo primæva.	Phil. G. Y.	.	.	*	.	Fermanagh. [tinny.	
Anatina attenuata.	M'C. viii. 6.	.	.	*	.	Killalla, in black oolitic limestone.	
,, deltoidea.	M'C. viii. 7.	.	*	*	.	Killybrone, Cleenishgarve.	
Pandora clavata.	M'C. xi. 2.	.	*	.	.	Carrowmacrory.	
Edmondia compressa.	M'C. xiii. 10.	.	.	*	.	Cork.	
Lutraria elongata.	M'C. viii. 3.	.	*	.	.	Dromard.	
,, primæva.	Port. 36. 5.	.	.	*	.	Tyrone.	
,, prisca.	M'C. xii. 4.	.	.	**	.	Millecent, Blacklion.	
Mactra incrassata.	M'C. xix. 8.	.	.	*	.	Chickenhill.	
,, ovata.	M'C. xi. 3.	.	.	*	.	Killalla.	
Kellia gregaria.	M'C. xi. 5.	.	*	.	.	Cultra.	
Psammobia decussata.	M'C. x. 2.	.	.	*	.	Little Island.	
Lucina antiqua.	M'C. viii. 9.	.	*	.	.	Ballintrillick.	
,, Du Noyeri.	Port. 38. 12.	.	*	.	.	Tyrone.	
Ungulina antiqua.	M'C. viii. 8.	.	*	.	.	Bundoran, *common*.	
Amphidesma subtruncata.	M'C. x. 10.	.	**	*	.	Ballintrillick, Bundoran, Millecent.	
,, deltoidea.	Port. 36, 37.	.	*	.	.	Tyrone.	
Corbis cancellata.	M'C. viii. 14.	.	.	*	.	Carrigoline.	
Venus centralis.	M'C. xi. 6.	.	*	.	.	Cullion.	
,, tenuistriata.	M'C. viii. 10.	.	*	.	.	Lisnapaste.	

[a] Acroculia, was Pileopsis. [b] Solenopsis, was Solen. [c] Sanguinolites, was Sanguinolaria.

NAME.	AUTHORITY.	O. R. Sl.	Cal. Sl.	Limest.	Coal.	LOCALITIES.	Other localities.
DITHYRA—*continued.*							
Pullastra antiqua.	Sow. G. T.	.	*	.	.	Cultra.	
,, bistriata.	Port.	.	**	*	.	Lisnapaste, Rush, Howth.	
,, crassistria.	M'C. xi. 7.	.	*	.	.	Crosspatrick.	
,, elegans.	M'C. viii. 16.	.	*	.	*	Bundoran, Carrownanalt.	
,, elliptica[a].	Phil. G. Y.	.	*	.	*	Bruckless, Glenbane.	
,, ovalis.	M'C. viii. 20.	.	**	.	.	Lisnapaste, Crosspatrick.	
,, parallella[a].	Phil. G. Y.	.	*	.	*	Lisnapaste, Glenbane.	
Astarte gibbosa.	M'C. viii. 11.	.	*	.	.	Bruckless.	
,, quadrata.	M'C. xi. 4.	.	.	*	.	Ballymeeny.	
Cyprina Egertoni.	M'C. x. 9.	.	.	***	.	Millecent, Horath, Chickenhill.	
Donax primigenius.	M'C. x. 7.	.	.	*	.	Cookstown.	
Cardium orbiculare.	M'C. xii. 7.	.	.	**	.	Little Island, Leck.	
Cardiomorpha[b] axiniformis.	Phil. G. Y.	.	.	*	.	Millecent.	
,, corrugata.	M'C. viii. 15.	.	.	*	.	Millecent.	
,, oblonga[b].	Phil. G. Y.	.	.	***	.	Millecent, Howth, Ballyduff.	5
,, ventricosa.	M'C. xiii. 3.	.	.	*	.	Cork.	
Pleurorynchus aliformis.	Phil. G. Y.	.	**	.	*	Hook, Malahide, Carrownanalt.	4
,, armatus.	Phil. G. Y.	.	.	*	.	Howth.	
,, fusiformis.	M'C. ix. 3.	.	.	**	.	Malahide, *common*, Hook.	
,, giganteus.	M'C. ix. 1.	.	.	***	.	Ardloughil, St. John's Point, Hook.	7
,, Hibernicus.	Phil. G. Y.	.	.	***	.	Millecent, Castle Island, Clonea.	5
,, inflatus.	M'C. ix. 2.	.	.	*	.	Carrickboy.	
,, minax.	Phil. G. Y.	.	*	**	.	Finner, Howth, Millecent.	5
,, nodulosus.	M'C. ix. 4.	.	*	.	.	Drumod.	
,, trigonalis.	Phil. G. Y.	.	*	*	.	Lisnapaste, Clontruk.	
Cypricardia alata.	M'C. x. 4.	.	**	.	.	Bruckless, Araglin.	
,, concinna.	M'C. viii. 24.	.	*	.	.	Cullion.	
,, cuneata.	M'C. viii. 25.	.	.	**	.	Blacklion, Balsitric.	
,, cylindrica.	M'C. viii. 23.	.	**	.	.	Ballinglen, Araglin.	
,, modiolaris.	M'C. viii. 27.	.	.	*	.	Killalla.	
,, oblonga.	M'C. viii. 21.	.	**	.	.	Ballinglen, Araglin.	
,, quadrata.	M'C. viii. 22.	.	**	.	.	Ballinglen, Araglin.	
,, rhombea.	Phil. G. Y.		**	*	.	Templeboy, Lisnapaste, Lackagh.	
,, sinuata.	M'C. viii. 26.	.	*	.	.	Araglin.	
,, socialis.	M'C. viii. 12.	.	*	.	*	Leam, *abundant*, Carrownanalt.	
,, tumida.	M'C. viii. 13.	.	*	.	.	Larganmore.	
Sedgwickia attenuata.	M'C. xi. 39.	.	*	.	.	River Bannagh.	
,, bullata.	M'C. viii. 19.	.	*	.	.	Cullion.	
,, corrugata.	M'C. viii. 18.	.	*	.	.	Mullaghtinny, *abundant.*	
,, gigantea.	M'C. xi. 40.	.	*	.	.	Carrowmacrory.	
,, globosa.	M'C. xi. 38.	.	**	.	.	Cullion, Ballinglen.	
,, minima.	M'C. viii. 17.	.	*	.	.	Cullion, *abundant.*	
,, tricostata.	Port. 34. 17.	.	.	*	.	Tyrone. [more.	
Axinus[c] axiniformis.	Port. 36. 6.	.	***	.	.	Mullaghtinny, Ballinglen, Largan-	
,, carbonarius[c].	Port. 36. 8.	.	***	.	.	Mullaghtinny, Kilcummin, Clogher.	
,, centralis.	M'C. xi. 8.	*	.	.	.	Ardshankill, *in yellow sandstone.*	
,, deltoideus[d].	Phil. P. F.	.	***	.	.	Abbey Bay, Bruckless, Ballinglen.	
,, nuculoides.	M'C. xi. 9.	.	**	.	.	Dromard, Fallagloon, *in masses.*	
,, obliquus.	M'C. viii. 29.	.	**	.	.	Mullaghtinny, Larganmore.	
,, obovatus.	M'C. viii. 30.	.	*	.	.	Mullaghtinny.	
,, orbicularis.	M'C. viii. 28.	.	*	.	.	Larganmore.	
Dolabra[e] angusta.	Phil. P. F.	.	.	*	.	Cultra, *in yellow limestone.*	
,, complanata[e].	Phil. P. F.	.	.	*	.	Cultra, *in yellow limestone.*	
,, corrugata.	M'C. xi. 12.	.	*	.	.	Leam.	
,, æquilateralis.	M'C. xi. 14.	.	*	.	.	Doorin.	
,, gregaria.	M'C. xi. 11.	.	*	.	.	Mullaghtinny.	
,, Hardingii[e].	Phil. P. F.	.	.	*	.	Cultra, *in yellow limestone.*	
,, orbicularis.	M'C. xi. 13.	*	.	.	.	Ardshankill, *in yellow sandstone.*	
,, rectangularis.	M'C. xi. 10.	.	*	.	.	Bundoran.	
,, securiformis.	M'C. xi. 15.	.	**	.	.	Larganmore, Rahan's Bay.	
,, trapezium[e].	Phil. P. F.	.	.	*	.	Cultra, *in yellow limestone.*	
,, unilateralis[e].	Sow. G. T.	.	.	*	.	Cultra, *in yellow limestone.*	
Leptodomus fragilis.	M'C. x. 11.	.	*	.	.	Locality lost.	
,, senilis[f].	Phil G. Y.	.	.	**	.	Millecent, Ardagh.	
Venerupis cingulatus.	M'C. x. 1.	.	.	*	.	Howth.	

[a] Pullastra, was Venus. [b] Cardiomorpha, was Isocardia. [c] Axinus, was Amphidesma.
[d] Axinus, was Cypricardia. [e] Dolabra, was Cucullæa. [f] Leptodomus, was Corbula.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
DITHYRA—*continued.*							
Venerupis obsoletus.	M'C. xi. 16.	.	.	*	.	Millecent.	
" scalaris.	M'C. x. 6.	.	.	**	.	Millecent, Howth.	
ATRACHIA.							
Nucula[a] attenuata.	Phil. G. Y.	.	***	.	.	Larganmore, Ballintrillick, Ballycas- [tle.	
" birostrata.	M'C. xii. 23.	.	***	.	.	Abbey Bay, Lisnapaste, Bruckless.	
" brevirostris.	Phil. G. Y.	.	.	.	*	Glenbane.	
" carinata.	M'C. xi. 21.	.	*	.	.	Lisnapaste.	
" clavata.	M'C. xi. 25.	.	**	.	*	Bruckless, Ballycastle, Glenbane.	
" cylindrica.	M'C. xi. 26.	.	**	*	.	Rahoran, Bundoran, Killeshandra.	
" delta.	M'C. xi. 22.	.	.	.	.	Locality lost.	
" gibbosa[b].	Phil. G. Y.	.	*	.	*	Bruckless, Glenbane.	
" leiorynchus.	M'C. xi. 27.	.	***	.	.	Rahoran, Larganmore, Abbey Bay.	
" lævirostrum.	Port. 36. 12.	.	*	*	.	Tyrone, Armagh.	
" linearis[c].	Phil. P. F.	.	*	.	.	Lisnapaste.	
" longirostris.	M'C. xi. 19.	.	***	.	.	Mullaghtinny, Larganmore, Raho- [ran.	
" oblonga.	M'C. xi. 24.	.	**	.	.	Monaduff, Corick.	
" Phillipsii[d].	Phil. G. Y.	.	**	.	*	Bruckless, Lisnapaste, Glenbane.	
" rectangularis.	M'C. xi. 20.	.	*	*	.	Lisnapaste, Cookstown.	
" stilla.	M'C. xi. 18.	.	***	.	.	Dromard, Leam, Rahoran.	
" unilateralis.	M'C. xi. 17.	.	**	.	.	Lisnapaste, Abbey Bay.	
Arca cancellata.	Sow. M. C.	.	*	*	.	Lisnapaste, Blacklion.	
" fimbriata.	M'C. xii. 8.	.	.	**	.	Cregg, Ballyduff.	
Cucullæa arguta.	Phil. G. Y.	.	.	***	.	Bantyre, Mallow, Blacklion.	
" tenuistria.	M'C. xii. 10.	.	*	**	.	Ballyodonnell, Millecent, Rathgillen.	
Byssoarca clathrata.	M'C. xi. 34.	.	*	.	.	Finner.	
" costellata.	M'C. xi. 36.	.	.	*	.	Blacklion.	
" lanceolata.	M'C. xi. 33	.	*	.	.	Lisnapaste.	
" obtusa[e].	Phil. Sp. G. Y.	.	.	*	.	Millecent.	
" reticulata.	M'C. xii. 9.	.	*	**	.	Bundoran, Millecent, Blacklion.	
" semicostata.	M'C. xi. 35.	.	*	.	.	Manorhamilton.	
Crenella acutirostris.	M'C. xi. 37.	*	.	.	.	Bruckless, *the sandstone yellow.*	
Modiola amygdalina.	Phil. P. F.	.	**	.	.	Lisnapaste, Larganmore.	
" angusta[f].	Port. 34. 15.	.	*	.	.	Larganmore.	
" concinna.	M'C. xi. 28.	.	.	**	.	Blacklion, Killeshandra.	
" divisa.	M'C. xi. 30.	.	**	.	.	Larganmore, Carrowmacrory.	
" lingualis.	Phil. G. Y.	.	*	.	.	Bruckless.	
" Macadami.	Port. 34. 13.	.	*	.	**	Larganmore, Cultra, Moyheeland.	5
" megaloba.	M'C. xi. 31.	*	.	.	.	Ardshankill, *the sandstone yellow.*	
" patula.	M'C. xiii. 13.	.	.	*	.	Cork.	
" scalaris.	Phil. P. F.	.	**	.	.	Larganmore, Rahoran.	
" subparallela.	Port. 34. 16.	.	*	.	**	Larganmore, Fallagloon, Cultra.	3
Lithodomus dactyloides.	M'C. xi. 41.	*	.	*	.	Hook Point, Millecent.	
Lanistes obtusus.	M'C. xi. 9.	.	.	*	.	Killymeal.	
" rugosus.	M'C. x. 8.	.	.	.	.	Locality lost.	
Mytilus comptus.	M'C. xiii. 12.	.	*	.	.	Carrowmacrory.	
" Flemingi.	M'C. xi. 29.	.	.	*	.	Millecent.	
Inoceramus auriculatus.	M'C. xix. 5.	.	.	*	.	Cork.	
" lævissimus.	M'C. xix. 6.	.	.	*	.	Cork.	
" orbicularis.	M'C. xiii. 11.	.	.	*	.	Millecent.	
" pernoides.	Port. 38. 5.	*	.	.	.	Derryloran.	
" vetustus.	Phil. G. Y.	.	*	*	*	Killaghtee, Millecent, Carrownanalt.	
Posidonia Becheri.	Phil. P. F.	.	.	.	***	Corry, Ballintrea, Walterstown.	3
" complanata.	Port. 34. 12.	*	**	.	.	Banada, Clogher, Moyheeland.	3
" costata.	M'C. xiii. 15.	.	.	.	*	Ballintree.	
" lateralis.	Phil. P. F.	.	.	.	**	Ballintree, Carrownanalt.	
" membranacea.	M'C. xiii. 14.	.	.	.	***	Walterstown, Baldongan, Carrowna- [nalt.	
" similis.	M'C. xii. 2.	.	.	.	**	Walterstown, Courtlough.	
" transversa.	Port. 38. 9.	.	*	.	.	Fermanagh.	
" tuberculata.	Phil. P. F.	.	.	.	***	Corry, Carrownanalt, Ballintree.	
Meleagrina alternata.	M'C. xiii. 17.		*	*	.	Rahoran, *plentiful*, Easky.	
" echinata.	M'C. xiii 18	*	.	.	.	Lisnapaste.	

[a] Nucula attenuata, was Nucula claviformis.
[b] Nucula gibbosa, was Nucula tumida.
[c] Nucula linearis, was Nucula lineata.
[d] Nucula Phillipsii, was Nucula undulata.
[e] Byssoarca obtusa, was Cucullæa obtusa.
[f] Modiola angusta, was Modiola Macadami, *var.*

NAME.	AUTHORITY.	O. R. S.	Cal. Sl.	Limest.	Coal.	LOCALITIES.	Other localities.
ATRACHIA—*continued.*							
Meleagrina elongata[a].	Port. p. 438.	*	.	.	.	Fermanagh.	
„ lævigata.	M'C. xii. 5.	.	.	***	.	Millecent, Ardagh, Howth.	
„ pulchella.	M'C. xii. 6.	.	*	**	.	Araglin bridge, Millicent, Ardagh.	
„ quadrata.	M'C. x. 5.	.	.	***	.	Millecent, Blacklion, Mullawornia.	
„ radiata[b].	Phil. G. Y.	.	*	**	.	Ballinglen, Knockninny, Blacklion.	
„ rigida.	M'C. xiii. 16.	.	*	.	.	Lisnapaste. [lough's.	
„ tesselata[c].	Phil. G. Y.	.	.	***	.	Blacklion, Cornacarrow, St. Dou-	
Pteronites angustatus.	M'C. xiii. 6.	*	.	.	.	Bruckless, *in sandstone.*	
„ latus.	M'C. xiii. 7.	.	.	*	.	Millecent.	
„ semisulcatus.	M'C. xi. 32.	.	.	**	.	Killymeal, Blacklion.	
„ sulcatus.	M'C. xiii. 5.	.	.	*	.	Manorhamilton.	
„ ventricosus.	M'C. xiii. 8.	*	.	.	.	Ardshankill, *in yellow sandstone.*	
Pterinea desquamata.	M'C. xiii. 2.	.	.	*	.	Cork.	
„ intermedia.	M'C. xiii. 1.	.	*	.	.	Corlave, *common.*	
Avicula angusta.	M'C. xiii. 20.	.	*	.	.	Rahan's Bay.	
„ bicostata.	M'C. xiii. 26.	.	*	.	.	Corlave, *abundant.*	
„ flabellula.	M'C. xiii. 27.	.	*	.	.	Bundoran.	
„ gibbosa.	M'C. xiii. 25.	.	.	*	.	Manorhamilton.	
„ informis.	M'C. xiii. 21.	.	*	.	.	Killogunra.	
„ laminosa.[d]	Phil. G. Y.	.	**	*	.	Bruckless, Bundoran, Millecent.	
„ lævigata.	M'C. xiii. 23.	.	.	*	.	Millecent.	
„ lunulata.	Phil. G. Y.	.	.	***	.	Millecent, Ardagh, Mullawornia.	
„ recta.	M'C. xiii. 24.	.	.	*	.	Millecent.	
„ squamosa.	Phil. G. Y.	.	*	.	.	Ballintrillick.	
„ Thompsoni[e].	Port. 25, A. 30.	.	*	.	.	Rahoran, *abundant.*	
„ Verneuilli.	M'C. xiii. 19.	.	**	.	.	River Bannagh, Drumcurren.	
Pinna[f] flabelliformis.	Phil. G. Y.	.	.	**	.	Easky, Cookstown.	
„ flexicostata.	M'C. xix. 1.	.	.	*	.	Easky.	
„ inequicostata.	Port.	.	.	*	.	Ballinglen.	
„ mutica.	M'C. xix. 11.	.	*	.	.	Kilbride.	
Lingula marginata.	Phil. G. Y.	.	*	.	.	Dromard.	
„ parallela.	Phil. G. Y.	.	*	.	.	Locality lost.	
„ squamiformis.	Phil. G. Y.	.	*	.	.	Leam, *abundant.*	
Anomia antiqua.	M'C. xix. 7.	.	.	*	.	Millecent.	
Malleus orbicularis.	M'C. xix. 2.	.	.	*	.	Feermaght.	
Lima alternata.	M'C. xv. 4.	.	.	**	.	Killymeal, Ardagh.	
„ concinna.	M'C. xv. 6.	.	*	.	.	Ballinglen, *common.*	
„ decussata.	M'C. xv. 3.	.	.	*	.	Killymeal.	
„ lævigata.	M'C. xiv. 3.	.	.	**	.	Millecent, Blacklion.	
„ obliqua.	M'C. xv. 7.	.	*	.	.	Ballintrillick.	
„ planicostata.	M'C. xv. 5.	.	*	.	.	Bruckless.	
„ prisca.	M'C. xviii. 6.	.	.	*	.	Ardagh.	
„ semisulcata.	M'C. xv. 2.	.	*	.	*	Manorhamilton, Ballintree.	
Pecten æqualis.	M'C. xv. 13.	.	.	*	.	Killymeal.	
„ asperulus.	M'C. xvi. 5.	.	*	*	.	Bundoran, Blacklion.	
„ arachnoideus.	Phil. P. F.	.	**	.	.	Ballinacourty, Brickeen Bridge.	
„ arenosus.	Phil. G. Y.	.	.	***	.	Knockninny, Millecent, Howth.	
„ bellis.	M'C. xv. 15.	.	*	.	.	Rahoran, *abundant.*	
„ cancellatus.	M'C. xiv. 9.	.	.	*	.	Killymeal.	
„ cingendus.	M'C. xvii. 11.	.	*	.	.	Abbey Bay.	
„ clathratus.	M'C. xiv. 12.	.	.	*	.	Little Island.	
„ cœlatus.	M'C. xviii. 2.	.	.	**	.	Redbarn, Cookstown.	
„ cognatus.	M'C. xix. 4.	.	.	*	.	Clonalvy.	
„ comptus.	M'C. xv. 14.	.	*	.	.	Rahoran.	
„ concavus.	M'C. xv. 10.	.	*	.	.	Killogunra.	
„ concentricostriatus.	M'C. xiv. 5.	.	*	**	.	Ballinglen, Killymeal, Millecent.	
„ conoideus.	M'C. xvii. 2.	.	*	**	.	Templeboy, Killalla, Howth.	
„ consimilis.	M'C. xv. 16.	.	*	.	.	Rahoran, *abundant.*	
„ deornatus.	Phil. G. Y.	.	.	*	.	Little Island.	
„ depilis.	M'C. xvi. 11.	.	***	.	.	Abbey Bay, Ballintrillick, Ballinglen.	
„ dissimilis.	Flem., Br. An.	.	*	**	.	Ring, Millecent, Ballyduff.	
„ duplicicosta.	M'C. xv. 9.	.	**	.	.	Drumcurren, Larganmore. [nalt.	
„ ellipticus.	Phil. G. Y.	.	*	*	*	Ballintrillick, Millecent, Carrowna-	16
„ elongatus.	M'C. xvi. 9.	.	.	**	.	Millecent, Ardagh.	

[a] Meleagrina elongata, was Gervillia elongata.
[b] Meleagrina radiata, was Avicula radiata.
[c] Meleagrina tesselata, was Avicula tesselata.
[d] Avicula, was Gervillia.
[e] Avicula Thompsoni, was Pterinea Thompsoni.
[f] Pinna flabelliformis, was Pinna costata.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
ATRACHIA—*continued.*							
Pecten exiguus.	M'C. xv. 11.	.	*	.	.	Rahoran, *common.*	
" fallax.	M'C. xiv. 2.	.	**	*	.	Abbey Bay, Malahide, Millecent.	7
" filatus.	M'C. xiv. 10.	.	.	*	.	Millecent.	
" flabellulum.	M'C. xv. 17.	.	.	*	.	Tornaroan.	
" flexuosus.	M'C. xviii. 1.	.	.	***	.	Ballygasey, Armagh, Tonyshandeny.	
" Forbesii.	M'C. xv. 20.	.	.	**	.	Millecent, Blacklion.	
" gibbosus.	M'C. xviii. 5.	.	*	**	.	Ballinglen, Blacklion, Howth.	
" granosus.	Phil. G. Y.	.	*	**		Abbey Bay, Killymeal, Millecent.	6
" granulosus.	Phil. P. F.	.	*	*	*	Clonea, Ballyconnell, Carrownanalt.	
" Hardingii.	M'C. xv. 18.	.	**	.	.	Bruckless, Lisnapaste.	
" hians.	M'C. xvi. 6.	.	.	*	.	Millecent.	
" incrassatus.	M'C. xvi. 1.	.	**	*	.	Bruckless, Bundoran, Easky.	
" inornatus.	Phil. G. Y.	.	*	*	.	Ballinglen, Cork.	
" intercostatus.	M'C. xviii. 4.	.	.	**		Killymeal, *abundant*, Little Island.	
" interstitialis.	Phil. G. Y.	.	*	**	.	Ballintrillick, Knockninny, Killy-	6
" irregularis.	M'C. xv. 8.	.	**	.	.	Cullion, Rahoran. [meal.	
" Jonesii.	M'C. xvi. 10.	.	.	*		Blacklion, *rare.* [onny.	
" Knockonniensis.	M'C. xvii. 4.	.	***	.	.	Larganmore, Abbey Bay, Knock-	
" leiotis.	M'C. xv. 21.	.	*	*	.	Bundoran, Manorhamilton.	
" macrotis.	M'C. xvi. 13.	.	*	*	.	Bruckless, Manorhamilton.	
" megalotis.	M'C. xiv. 7.	.	*	**	.	Bundoran, Howth, Little Island.	
" meleagrinoides.	M'C. xvi. 3.	.	.	*	.	Millecent.	
" micropterus.	M'C. xv. 12.	.	**	.	.	Kildress, Killycloghy.	
" mundus.	M'C. xvii. 5.	.	*	*	.	Lisnapaste, Clonalvy.	
" Murchisoni.	M'C. xviii. 3.	.	*	**	.	Lisnapaste, Cregg, Tankardstown.	
" orbiculatus.	M'C. xiv. 8.	.	*	*	.	Ballintrillick, Manorhamilton.	
" Ottonis.	Port. 36. 10.	*	.	.	.	Drumkeeran.	
" ovatus.	M'C. xiv. 11.	.	.	*	.	Ardagh.	
" pera.	M'C. xv. 19.	.	.	*	.	Killalla, *common.*	
" planicostatus.	M'C. xiv. 6.	.	.	*	.	Little Island.	
" planoclathratus.	M'C. xvi. 2.	.	*	.	.	Bundoran.	
" plicatus.	Sow. M. C.	.	*	*	*	Ballyduff, Mullawornia, Corry.	3
" polytrichus.	Phil. P. F.	.	***	.	.	Bruckless, Lisnapaste, Ballintrillick.	
" quinquelineatus.	M'C. xvii. 6.	.	*	.	.	Mohill,	
" rugulosus.	M'C. xvii. 7.	.	*	.	.	Doorin.	
" sclerotis.	M'C. xvi. 4.	.	*	.	.	Bundoran.	
" Sedgwickii.	M'C. xiv. 4.	.	.	*	.	Little Island.	
" segregatus.	M'C. xvii. 3.	.	.	*	.	Manorhamilton.	
" semicircularis.	M'C. xvii. 10.	*	*	.	.	Bruckless, Lisnapaste.	
" semicostatus.	Port. 36. 9.	.	.	*	.	Tyrone.	
" semistriatus.	M'C. xvii. 9.	.	*	**	.	Mullaghfarry, Malahide, Ardagh.	
" serratus.	M'C. xvii. 8.	.	*	.	.	Lisnapaste, *common.*	
" simplex.	Phil. G. Y.	.	*	*	.	Cullion, *common*, Cork.	
" Sowerbii.	M'C. xiv. 7.	.	*	**	.	Bundoran, Millecent, Ballyduff.	6
" spinulosus.	M'C. xvii. 1.	.	*	.	.	Bruckless, *common.*	
" tabulatus.	M'C. xvi. 12.	.	*	.	.	Ballintrillick, *common.*	
" transversus.	Phil. P. F.	.	*	.	.	Clonea.	
" tripartitus.	M'C. xvi. 8.	.	.	*	.	Killymeal.	
" undulatus.	M'C. xvii. 12.	.	*	.	.	Lisnapaste. [nanalt.	
" variabilis.	M'C. xvi. 7.		*	*	*	Bundoran, Manorhamilton, Carrow-	
Monotis æqualis.	M'C. xv. 1.	.	*	.	.	Cullion.	
BRACHIOPODA.							
Orbicula cincta.	Port. 32. 15.	.	*	.	.	Benburb.	
" nitida.	Phil. G. Y.		*	.	*	Bundoran, Culkagh.	
" quadrata.	M'C. xx. 1.	.	*	.	.	Rahan's Bay.	
" trigonalis.	M'C. xx. 2.	.	*	.	.	Lisnapaste.	
ATHYRIDÆ.							
Crania vesiculosa.	M'C. xx. 3.	.	.	*	.	Millecent.	
Calceola sandalina.	Phil. P. F.	.	.	*	.	Ballyduff.	
Producta aculeata.	Sow. M. C.	.	*	**	.	Lisnapaste, Howth, Old Leighlin.	7
" antiquata.	Sow. M. C.	.	*	**	.	Lisnapaste, Millicent, Tankardstown.	27
" aurita.	Phil. G. Y.	.	.	***	.	Cookstown, Lackagh, Millicent.	12
" caperata[a].	Phil. P. F.	*	**	.	.	Hook, Larganmore, Malahide.	10

[a] Producta caperata, was Leptæna caperata.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
BRACHIOPODA—*continued.*							
Producta comoidea.	Sow. M. C.	.	.	**	*	Killymeal, Little Island, Glenbane.	10
„ concinna[a].	Phil. G. Y.	*	*	*	.	Hook, Lisnapaste, Killymeal.	49
„ corrugata.	M'C. xx. 13.	.	*	**	.	Larganmore, Millecent, Little Island.	16
„ costellata.	M'C. xx. 15.	.	.	*	.	Old Leighlin.	
„ Edelburgensis.	Phil. G. Y.	.	.	***	.	Tornaroan, Ballykea, Raheendoran.	8
„ elegans.	M'C. xviii. 13.	.	*	**	.	Bruckless, Cornacarrow, Millecent.	9
„ fimbriata.	Phil. G. Y.	.	*	**	.	Bundoran, Tornaroan, Little Island.	13
„ flexistria.	M'C. xx. 16.	.	.	*	.	Millecent.	
„ fragraria[b].	Phil. P. F.	.	**	*	.	Poulscadden, Clonea, Ardclogh.	
„ gigantea.	Sow. M. C.	.	.	***	.	Drumreagh Etra, Castle Espie, Armagh.	
„ granulosa.	Phil. G. Y.	.	.	***	.	Knockninny, Killukin, Millecent.	
„ hemispherica[c].	Sow. M. C.	.	*	**	.	Lisnapaste, Lackagh, Little Island.	40
„ intermedia.	M'C. xx. 4.	.	.	*	.	Millecent.	
„ interrupta[d].	Sow. G. T.	.	*	.	.	Ballinacourty.	
„ lasciniata.	M'C. xx. 12.	.	.	**	.	Millecent, Ballyduff.	
„ latissima.	Phil. G. Y.	.	*	**	.	Lisnapaste, Killymeal, Raheendoran.	9
„ laxispina.	Phil. G. Y.	.	.	***	.	Castle Espie, Salmon, Ballinacourty.	5
„ lirata.	Phil. G. Y.	.	*	**	.	Lisnapaste, Howth, Ballyduff.	
„ lobata.	Phil. G. Y.	.	*	**	.	Bruckless, Millecent, Tankardstown.	
„ longispina.	Sow. M. C.	.	**	*	.	Lisnapaste. Mohill, Howth.	
„ margaritacea.	Phil. G. Y.	.	**	*	.	Lisnapaste, Bundoran, Millecent.	5
„ Martini.	Sow. M. C.		.	***	.	Tornaroan, Cookstown, Millecent.	15
„ maxima.	M'C. xix. 12.	.	.	**	.	Mullaghfin, Cregg.	
„ membranacea[e].	Phil. P. F.	.	**	.	.	Lisnapaste, Ballinacourty.	
„ mesoloba.	Phil. G. Y.	.	.	***	.	Cornacarrow, Millecent, Little Island.	18
„ muricata.	Phil. G. Y.	.	.	*	.	Moore.	
„ ovalis.	Phil. G. Y.	.	*	**	.	Bundoran, Ballyduff, Carrigaline.	
„ pectinoides.	Phil. G. Y.	.	*	**	.	Abbey Bay, Millecent, Ballyduff.	8
„ prælonga[f].	Sow. G. T.	.	***	.	.	Lisnapaste, Toberelathan, Clonea.	
„ pugilis.	Phil. G. Y.	.	*	**	.	Lisnapaste, Malahide, Old Leighlin.	22
„ punctata.	Phil. G. Y.	.	*	**	.	Bundoran, Millecent, Carrigaline.	38
„ pustulosa.	Phil. G. Y.	.	*	**	.	Lisnapaste, Millecent, Tankardstown.	35
„ quincuncialis.	Phil. G. Y.	.	*	**	.	Lisnapaste, Millecent, Little Island.	20
„ rugata.	Phil. G. Y.	.	.	***	.	Blacklion, Millecent, Ballinacourty.	4
„ scabricula.	Phil. G. Y.	.	*	**	.	Lisnapaste, Millecent, Little Island.	29
„ scotica[g].	Phil. G. Y.	.	*	**	.	Bundoran, Millecent, Little Island.	35
„ setosa.	Phil. G. Y.	*	*	*	*	Hook, Bundoran, Millecent, Culkagh.	35
„ spinosa.	Sow. M. C.	.	**	*	*	Bruckless, Malahide, Drumdoe.	9
„ spinulosa.	Phil. G. Y.	.	.	.	.	Locality lost.	
„ striata[h].	Phil. G. Y.	.	.	*	.	Ardagh.	
„ subaculeata[i].	Ver. B. S. G. F.	.	**	.	.	Lisnapaste, Rahoran.	
„ sulcata.	Phil. G. Y.	.	*	**	.	Lisnapaste, Malahide, Carrigaline.	27
„ tortilis.	M'C. xx. 14.	.	*	.	.	Tullynagaigy.	
Leptagonia[j] analoga.	Phil. G. Y.	.	**	*	.	Ring, Currens, Millicent.	48
„ depressa.	Sow. M. C.	.	.	*		Millecent.	
„ multirugata.	M'C. xviii. 12.	.	.	*	.	Millecent.	
„ nodulosa[k].	Phil. P. F.	.	***	.	.	Mohill, Currens, Kilnamack.	
„ plicatilis.	Phil. G. Y.	.	.	***	.	Armagh, Salmon, Little Island.	7
„ rugosa[l].	Phil. P. F.	.	*	.	.	Ballinacourty.	
Leptæna convoluta.	Phil. P. F.	.	***	.	.	Lisnapaste, Hook, Ballinacourty.	
„ crassistria.	M'C. xx. 10.	.	***	.	.	Abbey Bay, Bundoran, Manorhamilton.	
„ Dalmaniana.	M'C. xx. 7.	.	***	.	.	Lisnapaste, St. John's Point, Abbey [Bay.	
„ gibberula.	M'C. xx. 11.	.	*	.	.	Lisnapaste.	
„ Hardrensis[m].	Phil. P. F.	.	*	*	*	Lisnapaste, Ballyduff, Cahernanalt.	
„ lata.	Sow. S. S.	.	*	.	.	Bruckless.	
„ multidentata.	M'C. xx. 8.	.	*	*	.	Ballybodonnel, St. John's Point.	

[a] Professor Haughton has lately obtained at Hook Point, in yellow sandstone, Lithodomus dactyloides, Sanguinolites sulcatus, Orthis crenistria, Atrypa pleurodon, Producta caperata, P. setosa, and P. concinna, which I have marked in the Old Red Sandstone column, some of them not having been found in that division before.

[b] Producta fragraria, was Leptæna fragraria.

[c] Producta hemispherica, was Producta aurita.

[d] Producta interrupta, was Leptæna interrupta.

[e] Producta membranacea, was Leptæna membranacea.

[f] Producta prælonga, was Leptæna prælonga.

[g] Producta scotica, was P. aurita.

[h] Producta striata, was Pinna inflata.

[i] Producta subaculeata, was Leptæna subaculeata.

[j] Leptagonia analoga, was Producta analoga.

[k] Leptagonia nodulosa, was Leptæna nodulosa.

[l] Leptagonia rugosa, was Leptæna rugosa.

[m] Leptæna Hardrensis, was Orthis Hardrensis.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
BRACHIOPODA—*continued.*							
Leptæna papyracea.	M'C. xxii. 2.	.	.	.	*	Courtlough, Castlecomer.	
" perlata.	M'C. xx. 9.	.	*	.	.	Rahoran, *very abundant.*	
" plicata[a].	Phil. P. F.	.	***	.	.	Lisnapaste, Ballinglen, Ballinacourty.	
" sericea.	Sow. S. S.	.	***	.	.	Lisnapaste, *abundant*, Clonea, Hook.	
" serrata.	M'C. xviii. 10.	.	.	*	.	Millecent.	
" sordida[b].	Sow. G. T.	.	***	.	.	Lisnapaste, Currens, Clonea.	8
" tuberculata.	M'C. xx. 5.	.	.	*	.	Millecent.	
" volva.	M'C. xviii. 14.	.	**	*	.	Bundoran, Hook, St. Doulough's.	
Orthis arachnoidea.	Phil. P. F.	.	**	*	.	Tinnycahill, Ring, Millecent.	19
" arcuata.	Phil. P. F.	.	***	.	.	Lisnapaste, Toberelathan, Clonea.	4
" Bechei.	M'C. xxii. 3.	.	*	.	.	Whiting Bay.	
" caduca.	M'C. xxii. 6.	.	*	.	.	Rahoran, *seventeen specimens.*	
" circularis.	M'C. xx. 19.	.	*	.	.	Lisnapaste.	
" comata.	M'C. xxii. 5.	.	*	.	.	Currens.	
" compressa.	Phil. P. F.	.	.	*	.	Castle Espie.	
" connivens[c].	Phil. G. Y.	.	.	*	.	Little Island.	
" crenistria.	Phil. G. Y.	*	*	*	.	Hook, Bundoran, Ballyduff.	83
" cylindrica.	M'C. xxii. 1.	.	.	*	.	Castle Espie.	
" divaricata.	M'C. xx. 17.	.	.	**	.	Millicent, Ballyduff.	
" filiaria[d].	Phil. G. Y.	.	**	*	.	Bruckless, Malahide, Old Leighlin.	11
" gibbera[e].	{ Port. M'C. xviii. 9. }	.	.	*	.	Cornagrade.	
" granulosa.	Phil. P. F.	.	***	.	.	Lisnapaste, Poulscadden, Ballinacourty.	
" interlineata.	Phil. P. F.	.	***	.	.	Lisnapaste, Poulscadden, Currens.	16
" Kellii.	M'C. xxii. 4.	.	*	*		Aghintain, Annaghilla, *abundant.*	
" latissima.	M'C. xx. 20.	.	*	*	.	Rahan's Bay, St. John's Point.	
" longisulcata.	Phil. P. F.	.	*	*	.	Ballinacourty, Ballyduff.	
" orbicularis.	Sow. S. S.	.	**	*	.	Lisnapaste, Kilbride, Ardagh.	
" papillionacea[f].	Phil. G. Y.	.	*	**	.	Bundoran, Termon, Millecent.	21
" parallella.	Phil. P. F.	.	***	.	.	Lisnapaste, Bundoran, Clonea.	14
" quadrata.	M'C. xx. 18.	.	*	.	.	Ballintrillick.	
" radialis.	Phil. G. Y.	.	*	*	.	Stridagh Point, Ardagh.	
" resupinata.	Phil. P. F.	.	*	**	.	Bundoran, Cookstown. Millecent.	25
" semicircularis.	Phil. P. F.	.	***	.	.	Bruckless, Currens, Ballinacourty.	5
" sulcata.	M'C. xx. 6.	.	***	.	.	Bruckless, Ballintrillick, Currens.	
" tenuistriata.	Sow. G. T.	.	***	.	.	Lisnapaste, Currens, Shanbally.	
" umbraculum.	Port. 37. 5.	.	*	*	.	Abbeylands, Enniskillen.	
DELTHYRIDÆ.							
Spirifer aperturata.	Phil. P. F.	.	***	.	.	Lisnapaste, Clonea, Ardoe.	
" attenuata.	Phil. G. Y.	.	*	**	.	Lisnapaste, Cornacarrow, Millecent.	20
" bicarinata.	M'C. xxii. 10.	.	.	*	.	Millecent.	
" bisulcata.	Sow. M. C.	.	*	**	.	Ballintrillick, Millecent, Little Island.	11
" calcarata.	M'C. xxi. 3.	.	**	*	.	Lisnapaste, Riniskiddy, Little Island.	16
" choristites[g].	Von Buch.	.	.	*	.	Little Island, *abundant.*	
" clathrata.	M'C. xix. 9.	.	*	.	.	Lisnapaste.	
" convoluta.	Phil. G. Y.	.	*	.	.	Lisnapaste.	
" costata.	Sow. G. T.	.	**	.	*	Abbey Bay, Currens, Cahernanalt.	
" crispa.	Sow. S. S.	.	***	.	*	Lisnapaste, Malahide, Carrownanalt.	5
" decemcostata.	M'C. xxii. 9.	.	.	*	.	Millecent.	
" disjuncta.	Phil. P. F.	.	**	*	.	Lisnapaste, Currens, Ardclogh.	17
" extensa.	Sow. G. T.	.	*	.	.	Currens,	
" furcata.	M'C. xxii. 12.	.	.	*	.	Millecent.	
" fusiformis.	Phil. G. Y.	.	*	*	.	Killinamack, Millecent.	
" gigantea.	Phil. P. F.	.	**	*	.	Lisnapaste, Bundoran, Tullyoran.	10
" grandæva.	Phil. P. F.	.	***	.	.	Lisnapaste, Currens, Shanbally.	
" inornata.	Sow. G. T.	.	***	.	.	Toberelathan, Curragh, Shanbally.	
" insculptus.	Phil. G. Y.	.	.	.	.	Ireland.	
" megaloba.	Phil. P. F.	.	**	.	.	Currens, Poulscadden.	
" mesomala.	Phil. P. F.	.	.	.	.	Locality lost.	
" minima.	Sow. M. C.	.	*	.	.	Clonkeeffy, Rathcline, Old Leighlin.	3
" octoplicata.	Sow. M. C.	.	**	*	.	Bundoran, Carrowmably, Cregg.	5

[a] Leptæna plicata, was Orthis plicata.
[b] Leptæna sordida, was Orthis sordida.
[c] Orthis connivens, was Spirifera connivens.
[d] Orthis filiaria, was Spirifera filiaria.
[e] Orthis gibbera, was Atrypa gibbera.
[f] Orthis papillionacea, was Spirifera papillionacea.
[g] Spirifer choristites, was Choristites mosquensis.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
BRACHIOPODA—*continued.*							
Spirifer ornithoryncha.	M'C. xxi. 2.	.	.	*	.	Millecent.	
" ostiolata.	Phil. P. F.	.	**	*	.	Malahide, Clonea, Bundoran.	10
" partita.	Port. T. 38. 3.	*	.	.	.	Kildress.	
" princeps.	M'C. xxi. 1.	.	.	*	.	Ardclogh.	
" pulchella.	Sow. G. T.	.	.	.	.	Locality lost.	
" quinqueloba.	M'C. xxii. 7.	.	.	*	.	Ardagh.	
" rhomboidea.	Phil. G. Y.		*	**	.	Lisnapaste, Knockninny, Millicent.	8
" retundata.	Phil. G. Y.	.	*	**	.	Malahide, Millecent, Little Island.	7
" rudis.	Phil. P. F.	.	*	*	.	Ballinacourty, Howth.	
" speciosa.	Phil. P. F.	.	***	.	.	Bundoran, Currens, Clonea.	13
" striata.	Sow. M. C.	.	.	***	.	Rathcline, Millecent, Little Island.	4
" transiens.	M'C. xix. 14.	.	.	*	.	Clonalvy, *abundant.*	
" trigonalis.	Sow. M. C.	.	*	**	.	Larganmore, Milverton, LittleIsland.	4
" urii[a].	Phil. P. F.	.	***	.	.	Lisnapaste, Ballintrillick Poulscadden.	
Cyrtia cupidata[b].	Phil. G. Y.	.	*	**	.	Lisnapaste, Millecent, Ballyduff.	11
" distans[b].	Sow. M. C.	.	**	*	.	Bundoran, Malahide, Millecent.	12
" dorsata.	M'C. xxii. 14.	.	.	*	.	Cork.	
" laminosa.	M'C. xxi. 4.	.	*	**	.	Stridagh Point, Malahide, Hook.	5
" linguifera[c].	Phil. P. F.	.	.	***	.	Ardagh, Rathmoyle, Millecent.	5
" mesogonia.	M'C. xxii. 13.	.	.	**	.	Millecent, Hook.	
" nuda[b].	Phil. P. F.	.	**	.	.	Clonea, Riniskiddy.	
" semicircularis[b].	Phil. G. Y.	.	**	*	.	Mohill, Malahide, Slane.	3
" senilis[b].	Phil. G. Y.	.	.	**	.	Cookstown, Armagh.	
" simplex[b].	Phil. P. F.	.	*	**	.	Lisnapasté, Malahide, Hook.	3
" subconica[b].	Phil. P. F.	.	*	.	.	Bundoran.	
Martinia[d] decora.	Phil. G. Y.	.	*	**	.	Clonea, Mullaghboy, Mullaghfin.	
" elliptica.	Phil. G. Y.	.	**	*	.	Ballybodonnel, Malahide, Millecent.	
" glabra.	Phil. G. Y.	.	*	*	*	Malahide, Little Island, Carrownanalt.	11
" mesoloba.	Phil. G. Y.	.	.	***	.	Laracor, Millecent, Tankardstown.	3
" oblata.	Phil. G. Y.	.	.	***	.	Cornacarrow, Millecent, Little Island.	6
" obtusa.	Sow. M. C.	.	*	**	.	Malahide, Millecent, Little Island.	7
" phalæna.	Phil. P. F.	.	**	*	.	Lisnapaste, Clonea, St. Doulough's.	
" plebeia.	Phil. P. F.	.	*	**	.	Lisnapaste, Mullaghfin, Millecent.	16
" protensa.	Phil. P. F.	.	.	.	.	Locality lost.	
" rhomboidalis.	M'C. xxii. 11.	.	.	*	.	Cork.	
" strigocephaloides.	M'C. xxii. 8.	.	*	*	.	Lisnapaste, Old Leighlin.	
" symmetrica.	Phil. G. Y.	.	*	*	.	Mullaghfin, Little Island.	
Reticularia[e] imbricata.	Phil. G. Y.	.	*	**	.	Lisnapaste, Ardagh, Little Island.	8
" lineata.	Phil. G. Y.	.	*	**	.	Larganmore, Millecent, Little Island.	8
" microgemma.	Phil. P. F.	.	**	*	.	Bundoran, Malahide, Hook.	3
" reticulata.	M'C. xix. 15.	.	.	***	.	Tornaroan, Armagh, Bannaghagole.	
" striatella.	M'C. xix. 13.	.	.	*	.	Termon. —	
Brachythyris[f] duplicicosta.	Phil. G. Y.	.	*	*	*	Lisnapaste, Malahide, Mullaghfin.	6
" exarata.	Flem. Br. An.	.	*	**	.	Ballintrillick, Rathcline, Old Leighlin.	
" hemispherica.	M'C. xix. 10.	.	.	*	.	Armagh.	
" integricosta[f].	Phil. G. Y.	.	*	**	.	Bundoran, Millecent, Little Island.	6
" linguifera[f].	Phil. G. Y.	.	.	.	.	Locality lost.	
" ovalis.	Phil. G. Y.	.	*	*	.	Ballinacourty, Ballyduff.	
" pinguis.	Sow. M. C.	.	*	**	.	Cullion, St. Doulough's, Millecent.	15
" planata.	Phil. G. Y.	.	*	**	.	Bundoran, Ardclogh, Little Island.	
" planicostata.	M'C. xxi. 5.	.	*	**	.	Bruckless, Killymeal, Bannaghagole.	6
Athyris[g] concentrica.	Von Buch.	.	**	*	.	Larganmore, Malahide, Hook.	8
" decussata[h].	Phil. P. F.	.	**	*	.	Lisnapaste, Carrowmably, Tornaroan.	12
" depressa.	M'C. xviii. 7.	.	***	.	.	Lisnapaste, Malahide, Hook.	
" expansa[h].	Phil. G. Y.	.	**	*	.	Bruckless, Drumdoe, Milverton.	
" fimbriata[h].	Sow. M. C.	.	**	*	.	Lisnapaste, Bundoran, Boyle.	
" glabistria[h].	Phil. G. Y.	.	*	**	.	Bundoran, Millecent, Little Island.	6
" globularis[h].	Phil. G. Y.	.	*	**	.	Larganmore, Millecent, Little Island.	10
" hispida[i].	Sow. G. T.	.	***	.	.	Kildress, Carrowmably, St. John's.	
" planosulcata[h].	Phil. G. Y.	.	*	*	*	Lisnapaste, Rathgillen, Culkagh.	

[a] Spirifer urii, was Spirifera unguiculus.
[b] Cyrtia, was Spirifera.
[c] Cyrtia linguifera, was Spirifera ostiolata.
[d] Martinia, was Spirifera.
[e] Reticularia, was Spirifera.
[f] Brachythyris, was Spirifera.
[g] Athyris concentrica, was Terebratula concentrica.
[h] Athyris, was Spirifera.
[i] Athyris hispida, was Atrypa hispida.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
BRACHIOPODA—*continued.*							
Athyris squamosa[a].	Phil. G. Y.	.	*	**	.	Lisnapaste, Hook, Moore.	
„ triloba.	M'C. xx. 21.	.	.	*	.	Drumscraw.	
Actinoconchus paradoxus.	M'C. xxi. 6.	.	.	***	.	Blacklion, Millecent, Little Island.	
Atrypa[b] acuminata.	Phil. G. Y.	.	.	***	.	Mullaghfin, Millecent, Little Island.	
„ angularis.	Phil. P. F.	.	*	.	.	Ballinglen, *three specimens.*	
„ anisodonta.	Phil. P. F.	.	*	*	.	Rahoran, Cork.	
„ aspera[c].	Sow. G. T.	.	*	.	.	Poulscadden.	
„ bifera.	Phil. P. F.	.	**	*	.	Malahide, Currens, Millecent.	
„ canalis.	Sow. S. S.	*	.	.	.	Kildress.	
„ compta.	Phil. P. F.	.	**	.	.	Kilcummin, Ballinglen.	
„ cordiformis.	Sow. M. C.	.	.	**	.	Millecent, Little Island.	
„ desquamata.	Phil. P. F.	.	**	.	.	Clonea, Ballinacourty.	
„ excavata.	Phil. G. Y.	.	.	**	.	Ardagh, *abundant*, Ardclogh.	
„ expansa.	Phil. G. Y.	.	.	.	.	Ireland.	
„ fallax.	Phil. G. Y.	*	**	.	.	Hook, Cultra, Bruckless, *common.*	13
„ ferita.	Phil. P. F.	.	**	*	.	Ballycastle, *Co. Antrim*, Claragh-more, Millecent.	
„ flexistria.	Phil. G. Y.	.	*	**	.	Rahoran, Knockninny, Millecent,	4
„ gregaria.	M'C. xxii. 18.	.	**	.	.	Ballinglen, Kilbride, White River.	
„ hastata.	Phil. G. Y.	.	*	**	.	Lisnapaste, Millecent, Little Island.	18
„ indentata.	Sow. G. T.	.	**	.	.	Lisnapaste, *common*, Larganmore.	
„ insperata.	Phil. P. F.	.	**	.	.	Clonea, Ballinacourty,	
„ isorhynca.	M'C. xviii. 8.	.	.	*	.	Clare.	
„ juvenis.	Phil. P. F.	.	**	.	.	Bruckless, Toberelathan.	
„ lachryma.	Sow. G. T.	.	*	*	.	Malahide, Howth, *common in one bed.*	
„ lateralis.	Sow. M. C.	.	.	.	.	Ireland.	
„ laticliva.	M'C. xxii. 16.	.	.	*	.	Cookstown.	
„ laticosta.	Phil. P. F.	.	***	.	.	Kildress, Cultra, Rahoran.	4
„ Mantiæ.	Sow. M. C.	.	.	.	.	Ireland.	
„ nana.	M'C. xxii. 19.	.	*	.	.	Rahoran, *common.*	
„ oblonga.	Sow. G. T.	.	*	.	.	Clonea,	
„ obtusa.	M'C. xxii. 20.	.	.	*	.	Milverton, *common.*	
„ planosulcata.	Phil. G. Y.	.	.	.	.	Ireland.	
„ platyloba.	Sow. M. C.	.	.	*	.	Little Island.	
„ pleurodon.	Phil. G. Y.	.	**	*	.	Malahide, Toberelathan, Millecent.	4
„ prisca[d].	Sow. M. C.	.	*	.	.	Shanbally.	
„ proava.	Phil. G. Y.	.	*	.	.	Malahide.	
„ pugnus.	Phil. G. Y.	.	.	***	.	Ardagh, Millecent, Little Island.	7
„ radialis.	Phil. G. Y.	.	**	*	.	Bruckless, Malahide, Millecent.	4
„ reniformis.	Phil. G. Y.	.	*	**	.	Lisnapaste, Millecent, Little Island.	
„ Roissyi.	Ver. B. S. G. F.	.	.	.	.	Dublin.	
„ sacculus.	Phil. G. Y.	.	*	**	.	Ardagh, Millecent, Little Island.	3
„ semisulcata.	M'C. xxii. 15.	.	.	.	***	Culkagh, Walterstown, Ballintree.	
„ striatula.	Sow. G. T.	.	***	.	.	Clonea, Curragh, Rinaskiddy.	
„ sublobata.	Port.	*	.	.	.	Kildress.	
„ sulcirostris.	Phil. G. Y.	.	**	*	.	Bruckless, Ballintrillick, Knock-ninny.	7
„ triangularis.	Sow. G. T.	.	.	*	.	Little Island.	
„ triplex.	M'C xxii. 17.	*	.	.	.	Kildress.	
„ ventilabrum.	Phil. G. Y.	.	*	**	.	Bundoran, Ardagh, Millecent.	5
„ virgoides.	M'C. xxii. 21.	.	.	*	.	Cork.	
Seminula pentacdra[e].	Phil. G. Y.	.	**	*	.	Kilcummin, Ballintrillick, Millecent.	
„ pisum.	Phil. G. Y.	.	.	***	.	Malahide, Howth, Laracor.	
„ rhomboidea.	Phil. P. F.	.	.	***	.	Cookstown, Blacklion, Howth.	
CRUSTACEA.							
Astacus Phillipsii.	M'C. xxiii. 1.	.	*	.	.	Hook.	
Calymene granulata.	Phil. P. F.	.	**	.	.	Clonea, Ballinacourty.	
„ lævis.	Phil. P. F.	.	*	.	.	Clonea.	
„ Latreillii.	Phil. P. F.	.	*	.	.	Clonea.	
Griffithides calcaratus[f].	M'C. iv. 3.	.	.	*	.	Roughan.	
„ globiceps.	Phil. G. Y.	.	.	**	*	Millecent, Howth, Carrownanalt.	
„ granuliferus.	Phil. G. Y.	.	.	*	.	Florence Court.	
„ longiceps.	Port. 11. 7.	.	*	.	.	Kildress.	

[a] Athyris, was Spirifera.
[b] Atrypa generally was Terebratula.
[c] Atrypa aspera, was Atrypa squamosa.
[d] Atrypa prisca, was Terebratula affinis.
[e] Seminula, was Terebratula.
[f] Griffithides, was Asaphus.

NAME.	AUTHORITY.	O. R. S.	Cal. Sl.	Limest.	Coal.	LOCALITIES.	Other localities.
CRUSTACEA—*continued.*							
Griffithides longispinus.	Port. 24. 12.	.	.	*	.	Co. Tyrone, Co. Kildare. [glogh.	
,, obsoletus.	Phil. G. Y.	.	**	*	.	Lisnapaste, Ballintrillick, Cartrona-	
,, platyceps.	Port. 11. 8.	.	.	*	.	Tyrone.	
Asaphus quadrilimbus.	Phil. G. Y.	.	.	*	.	Ireland.	
,, seminifera.	Phil. G. Y.	.	.	.	.	Ireland.	
Phillipsia cælata[a].	M'C. iv. 4.	.	.	*	.	Killymeal.	
,, Colei.	M'C. iv. 6.	.	*	.	.	Lisnapaste	
,, discora.	M'C. iv. 7.	.	.	*	.	Millecent.	
,, gemmulifera.	Phil. G. Y.	.	*	*	*	Lisnapaste, Millecent, Carrownanalt.	
,, Jonesii.	Port. 11. 3.	.	.	**	.	Armagh, Ballygasey,	
,, Kellii.	Port. 11. 1.	.	.	**	.	Cookstown, Millecent.	
,, Macoyii.	Port. 11. 6.	.	.	*	.	Millecent.	
,, mucronata.	M'C. iv. 5.	*	.	.	.	Kildress.	
,, quadriserialis.	M'C. iv. 8.	.	.	*	.	Millecent.	
,, truncatula.	Phil. G. Y.	.	**	.	*	Lisnapaste, Currens, Carrownanalt.	
Dithyrocaris Colei.	Port. 12.	.	*	.	.	Aghnaglogh.	
,, orbicularis.	Port. p. 316.	.	**	.	.	Whitewater River, Aghnaglogh.	
,, Scouleri.	M'C. xxiii. 2.	.	*	.	.	Aghnaglogh.	
,, tenuistriatus.	M'C. xxiii. 3.	.	.	*	.	Little Island.	
Limulus trilobitoides.	Buck. T. 46. 3.	.	*	.	.	Moyola River.	
Entomoconchus Scouleri.	M'C. xxiii. 4.	.	.	***	.	Blacklion, Millecent, Little Island.	
Daphnia primæva.	M'C. xxiii. 5.	.	*	.	.	Rahoran.	
Bairdia curtus.	M'C. xxiii. 6.	.	.	**	.	Granard, Ardclogh.	
,, gracilis.	M'C. xxiii. 7.	.	.	**	.	Armagh, Ardagh.	
Cythere amygdalina.	M'C. xxiii. 8.	.	***	.	.	Cultra, Dromard, Ballintrillick.	
,, arcuata.	M'C. xxiii. 9.	.	***	.	.	Cultra, Larganmore, Rahoran.	
,, bituberculata.	M'C. xxiii. 10.	.	***	.	.	Cultra, Corick, Dromard.	
,, costata.	M'C. xxiii. 11.	.	***	.	.	Cultra, Dromard, Rahoran.	
,, cornuta.	M'C. xxiii. 12.	.	**	*	.	Cultra, Larganmore, Raheendoran.	4
,, elongata.	M'C. xxiii. 13.	.	***	.	.	Cultra, Dromard, Rahoran.	
,, excavata.	M'C. xxiii. 14.	.	***	.	.	Cultra, Dromard, Rahoran.	
,, gibberula.	M'C. xxiii. 25.	.	***	.	.	Fallagloon, Abbeybay, Ballintrillick.	
,, Hibbertii.	M'C. xxiii. 15.	.	***	.	.	Fallagloon, Larganmore, Ballinglen.	
,, impressa.	M'C. xxiii. 16.	.	***	.	.	Cultra, Fallagloon, Leam.	4
,, inflata.	M'C. xxiii. 17.	.	**	*	.	Fallagloon, Poulscadden, Millecent.	12
,, inornata.	M'C. xxiii. 18.	.	***	.	.	Cultra, Fallagloon, Prughlish.	10
,, oblonga.	M'C. xxiii. 22.	.	***	.	.	Cultra, Fallagloon, Leam.	8
,, orbicularis.	M'C. xxiii. 19.	.	***	.	.	Fallagloon, Larganmore, Rahoran.	6
,, pusilla.	M'C. xxiii. 20.	.	***	.	.	Cultra, Corick, Dromard.	5
,, scutulum.	M'C. xxiii. 21.	.	***	.	.	Cultra, Dromard, Ballintrillick.	
,, spinigera.	M'C. xxiii. 23.	.	*	*	.	Ballintrillick, Armagh.	
,, trituberculata.	M'C. xxiii. 24.	.	*	.	.	Cultra.	
Cypris Scoto-Burdigalensis.	Port. 24. 13.	.	*	.	.	Derry, Tyrone.	
,, subrectus.	Port. T. 24. 13.	.	*	.	.	Derry, Tyrone,	
ANNELIDA.							
Serpula compressa.	Sow. M. C.	.	*	.	.	Bundoran.	
,, hexicarinata.	M'C. xxiii. 28.	.	**	.	.	Bundoran, Ballintrillick.	
,, parallela.	M'C. xxiii. 30.	.	***	.	.	Finner, Abbeybay, Ballintrillick.	
,, scalaris.	M'C. xxiii. 29.	.	*	.	.	Lisnapaste.	
,, socialis.	Port. T. 25. 9.	.	*	.	.	Clogher.	
,, subannulata.	Port. p. 363.	.	.	*	.	Kilcoshil, Tyrone.	
,, subcincta.	Port. p. 362.	.	.	*	.	Armagh.	
Spirorbis caperatus.	M'C. xxiii. 26.	.	*	.	.	Hook.	
,, globosus.	M'C. iv. 10.	.	**	.	.	Ballymacan, Aghnaglogh.	
,, intermedius.	M'C. iv. 9.	.	*	.	.	Cultra.	
,, minutus.	Port. 12. 3.	.	*	.	.	Aghnaglogh.	
,, omphalodes.	Gold.	.	**	.	.	Cultra, Fallagloon.	
Spiroglyphus marginatus.	M'C. xxiii. 27.	.	*	.	.	Hook.	
Serpulites carbonarius.	M'C. xxiii. 32.	.	.	*	.	Manorhamilton.	
,, membranaceus.	M'C. xxiii. 31.	.	*	.	.	St. Doulough's, *in black slate.*	
Sabella antiqua.	M'C. iv. 11.	*	**	.	.	Kildress, Cullion, Abbeybay.	

[a] Phillipsia, was Asaphus.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
ECHINODERMATA.							
Palechinus elegans.	M'C. xxiv. 2.	.	.	*	.	Hook.	
" ellipticus.	Scouler MSS. xxiv. 3.	.	.	*	.	Millecent.	
" gigas.	M'C. xxiv. 4.	.	**	*	.	Rahans Bay, St. John's Point, Hook.	
" Koenigii.	M'C. xxiv. 19.	.	**	.	.	Rahans Bay, Finner.	
" sphericus.	Scouler MSS. xxiv. 5.	.	.	*	.	Millecent.	
Echinocrinus[a] glabrispina.	Phil. G. Y.	.	***	.	.	Bundoran, Hook, Clonea.	
" Munsterianus.	Kon. xxvii. 2.	.	.	.	.	Locality lost.	
" triserialis.	M'C. xxvi. 1.	.	*	.	.	Kilycloghy.	
" Urii[b].	Flem. Br. An. M'C. xxvii. 1.	.	**	*	.	Tinnycahill, Bundoran, Manorhamilton.	8
" vetustus[a].	Phil. G. Y.	.	.	**	.	Hook, Ardagh.	
Adelocrinus histrix..	Phil. P. F.	.	*	.	.	Ballinacourty.	
Pentremites Derbiensis.	Phil. G. Y.	.	*	*	.	Manorhamilton, Knockninny.	
" ellipticus.	Sow. Z. J.	.	.	**	.	Manorhamilton, Howth.	
" florealis[c].	Phil. P. F.	.	.	*	.	Blacklion.	
Perischodomus biserialis.	M'C. A. N. H.	.	.	*	.	Hook Head.	
Platycrinus antheliontes.	Aus. M. Cr. 2. 3.	.	.	*	.	Hook Head.	
" contractus.	Phil. G. Y.	.	*	.	.	Toberelathan.	
" diadema.	M'C. A. N. H.	.	.	.	.	Fermanagh.	
" elongatus.	Aus. Cr. 2. 2.	.	.	.	.	Hook Head.	
" expansus.	M'C. xxv. 18. 19.	.	*	.	.	Finner	
" gigas.	Phil. G. Y.	.	**	.	.	Malahide, Hook.	
" granulatus.	Phil. G. Y.	.	*	.	.	Ballinacourty, *common.*	
" interscapularis.	Phil. P. F.	.	**	*	.	Clonea, Ballinacourty, Howth.	
" lasciniatus.	Phil. G. Y.	.	**	.	.	Finner, Hook.	
" lævis.	Mill.	.	.	*	.	Hook, *common and very fine.*	
" ornatus.	M'C. xxv. 1.	.	*	.	.	Hook.	
" pileatus.	Aus. Cr. 2. 3.	.	.	.	.	Ireland.	
" punctatus.	M'C. xxv. 15. 16. 17	.		*	.	St. John's Point.	
" ragosus.	Phil. G. Y.	.	.	***	.	Derryvullan, Ardclogh, Howth.	
" similis.	M'C. xxvi. 6.	.	*	.	.	Ballinacourty.	
" spinosus.	Aus. Cr. 1. 2.	.	.	*	.	Hook Head.	
" striatus.	Aus. Cr. 3. 3.	.	.	.	.	Hook Head.	
" triacontadactylus.	M'C. xxv. 2 to 7.	.	*	.	.	Hook.	
" trigentidactylus.	Aus. Cr. 3. 1.	.	.	*	.	Hook Head.	
" tuberculatus.	Phil. G. Y.	.	*	.	.	Ballinacourty.	
Poteriocrinus abbreviatus.	Aus. Cr. 2. 4.	.	.	*	.	Hook Head.	
" conicus.	Port. 16. 12.	.	.	*	.	Fermanagh.	
" crassimanus.	M'C. A. N. H.	.	.	*	.	Hook Head.	
" crassus.	Aus. Cr. 8. 3.	.	.	.	.	Ireland.	
" dactyloides.	Aus. Cr. 10. 7.	.	.	*	.	Hook Head.	
" gracilis.	M'C. xxv. 11 to 14.	.	*	.	.	Hook Head.	
" granulosus.	Aus. Cr. 9. 2.	.	.	.	.	Ireland.	
" impressus.	Phil. G. Y.	.	*	*	.	Malahide, Millecent.	
" isacobus.	Aus. Cr. 8. 4.	.	.	*	.	Hook Head.	
" quinquangularis.	Phil. G. Y.	.	.	.	.	Ireland.	
" radiatus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
" rostratus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
Taxocrinus macrodactylus[d].	Phil. G. Y.	.	***	.	.	Carrowmably, Clonea, Ballinacourty.	
" Egertoni[e].	Phil. G. Y.	.	.	*	.	Florence Court.	
" granulosus[e].	Phil. G. Y.	.	.	*	.	Enniskillen.	
" polydactylus.	M'C. xxvi. 7.	.	*	.	.	Ballintrillick, *rare.*	
Cyathocrinus conicus.	Phil. G. Y.	.	.	.	.	Locality lost, Ireland (Morris). [nalt.	
" ellipticus.	Phil. P. F.	.	**	.	*	Lisnapaste, Ballinacourty, Carrowa-	
" geometricus.	Phil. P. F.	.	***	.	.	Currens, Ballinacourty, Curragh.	
" inequidactylus.	M'C. xxvi. 8.	.	*	*	.	Malahide, Hook.	
" macrocheirus.	M'C. xxv. 8. 9. 10.	.	*	.	.	Rahans Bay.	
" megastylus.	Phil. P. F.	.	**	*	.	Lisnapaste, Mohill, St. Doulough's.	
" ornatus.	Phil. G. Y.	.	.	*	.	Malahide.	
" pinnatus.	Phil. P. F.	.	***	.	.	Lisnapaste, Larganmore, Clonea.	8
" planus.	Bronn. 4. 6.	.	.	*	.	Belmore Mountain.	

[a] Echinocrinus, was Cidaris.
[b] Echinocrinus Urii, was Cidaris Benburbiensis.
[c] Pentremites florealis, was Pentremites ovalis.
[d] Tarocrinus, was Isocrinus.
[e] Taxocrinus, was Poteriocrinus.

NAME.	AUTHORITY.	O. R. S.	Cal. Sl.	Limest.	Coal.	LOCALITIES.	Other localities.
ECHINODERMATA—*continued.*							
Cyathocrinus quinquangularis.	Aus. Cr. 10. 2.	.	.	.	.	Ireland.	
,, radatus.	Aus. Cr. 10. 1.	.	.	.	.	Ireland.	
,, rostratus.	Aus. Cr. 9. 2.	.	.	.	.	Ireland. [trillick.	
,, variabilis.	Phil. P. F.	.	**	*	.	Larganmore, Ballinacourty, Ballin-	13
Rhodocrinus abnormis.	M'C. xxvi. 3.	.	.	*	.	Millecent.	
,, costatus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
,, granulatus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
,, verus.	Gold. 60. 3.	.	.	*	.	Howth.	
Gilbertsocrinus simplex.	Port. T. 16. 15.	.	.	*	.	Fermanagh.	
Actinocrinus aculeatus.	Aus. A. N. H.	.	.	.	.	Hook Head.	
,, cataphractus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
,, constrictus.	M'C. xxvii. 3.	.	.	**	.	Manorhamilton, Chicken Hill.	
,, costus.	M'C. xxvi. 2.	.	.	*	.	Manorhamilton.	
,, decadactylus.	Port.	.	*	.	.	Tyrone.	
,, elephantinus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
,, globosus.	Phil. G. Y.	.	.	.	.	Ireland.	
,, granulatus.	Aus. A. N. H.	.	.	.	.	Hook Head.	
,, icosidactylus.	Port. T. 15. 7.	.	.	*	.	Hook Head.	
,, lævis.	Gold. 59. 3.	.	.	*	.	Locality lost.	
,, lævissimus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
,, longispinosus.	Aus. A. N. H.	.	.	*	.	Hook Head.	
,, polydactylus.	Phil. G. Y.	.	**	*	.	Hook, Ballinacourty, Millecent.	
,, pusillus.	M'C. xxvi. 4.	.	.	*	.	Malahide.	
,, tenuistriatus.	Phil. P. F.	.	**	.	*	Lisnapaste, Clonea, Carrownanalt.	
,, tesselatus.	Phil. G. Y.	.	*	.	.	Clonea. [cent.	
,, triacontadactylus.	Phil. G. Y.	.	**	*	.	Carrowmably, Manorhamilton, Mille-	8
Amphoracrinus[a] gigas.	Aus. M. Cr.	.	.	*	.	Derryvullan, *Fermanagh.*	
,, Gilbertsoni[b].	Aus. M. Cr.	.	*	.	.	Malahide.	
Synbathocrinus conicus.	Aus. Cr. 11. 5.	.	.	.	.	Hook Head.	
Phillipsocrinus caryocrinoides.	M'C. xxvi. 5.	.	*	.	.	Malahide, *rare.*	
Atocrinus Milleri.	M'C. xxv. 20.	.	*	.	.	Hook.	
ZOOPHYTA.							
Amplexus nodulsua.	Phil. P. F.	.	*	**	.	Clonea, Kilcommock, Millecent.	
,, Sowerbii.	Phil. G. Y.	.	.	***	.	St. John's Point, Millecent, Ballyduff.	17
,, tortuosus.	Phil. P. F.	.	*	**	.	Lisnapaste, Ballyduff, Tankardstown.	6
Turbinolopsis bina.	Phil. P. F.	.	**		.	Bruckless, Currens.	
,, celtica.	Phil. P. F.	.	***	.	.	Ballinglen, Killinamack, Clonea.	
,, pauciradialis.	Phil. P. F.	.	**	.	.	Currens, Ballinacourty.	
,, pluriradialis.	Phil. P. F.	.	**	.	.	Currens, Riniskiddy.	
Turbinolia expansa.	M'C. xxviii. 7.	.	.	*	*	Scraghy, Little Island.	
,, fungites.	Phil. G. Y.	.	**	*	.	Lisnapaste, Hook, Little Island.	50
Siphonophyllia cylindrica.	Sco. MSS. xxvii. 5.	.	*	**	.	Bundoran, Carlingford, Knocknarea.	22
Astræa aranea.	M'C. xxvii. 6.	.	.	*	.	Magheranore.	
,, crenularis[c].	Phil. G. Y.	.	.	***	.	Cookstown, Tumpher, Armagh.	
,, irregularis.	Port. T. 23. 4.	.	**	*	.	Mullaghtinny, Ballymacan, Easky.	
,, pentagona.	Phil. P. F.	.	*	*	.	Larganmore, Tornaroan.	
Lithostrotion[d] striatum.	Phil. G.Y.	.	.	***	.	Armagh, Athenry, Raheendoran.	12
Lithodendron[e] affine.	Phil. G. Y.	.	.	***	.	Drumscraw, Pulgulm, Ballyconnel.	7
,, cæspitosum[f].	Phil. G. Y.	.	.	***	.	Drumscraw, Millecent, Raheendoran.	7
,, coarctatum.	Port. T. 23. 5.	.	.	*	.	Cookstown.	
,, pauciradialis.	M'C. xxvii. 7.	.	.	*	.	Magheranore.	
,, sexdecimale.	Phil. G. Y.	.	*	**	.	Hook, St. John's Point, Howth.	
,, sociale.	Phil. G. Y.	.	*	**	.	Ballintrillick, Ballygasey, Roscom-	
Syringopora bifurcata.	Lons. S. S.	.	*	.	.	Poulscadden. [mon.	
,, catenata[g].	Lons. S. S.	.	***	.		Killaghtee, Lisnapaste, Ballinglen.	
,, geniculata.	Phil. G. Y.	.	*	**	.	Larganmore, Cornacarrow, Roscom-	11
,, laxa.	Phil. G. Y.	.	*	**	.	Bruckless, Killymeal, Kilmore. [mon.	

[a] Amphoracrinus gigas, was Actinocrinus amphora.
[b] Amphoracrinus, was Actinocrinus.
[c] Astræa crenularis, was Cyathophyllum crenulare.
[d] Lithostrotion striatum, was Cyathophyllum basaltiforme.
[e] Lithodendron affine, was Lithodendron longiconicum.
[f] Lithodendron cæspitosum, was Lithodendron fasiculatum.
[g] Syringopora catenata, was Syringopora reticulata.

Name.	Authority.	O. R. S.	Cal. Sl.	Limest.	Coal.	Localities.	Other localities.
ZOOPHYTA—*continued.*							
Syringopora ramulosa.	Phil. G. Y.	.	**	*	.	Rahan's Bay, Malahide, Drumscraw	3
Aulopora campanulata.	M'C. xxvi. 15.	.	*	*	.	Malahide, Hook.	
" gigas.	M'C. xxvii. 14.	.	*	.	.	Ballintrillick.	
Manon cribrosum.	Phil. P. F.	.	***	.	.	Bruckless, Hook, Clonea.	
Astreopora antiqua.	M'C. xxvi. 9.	.	*	.	.	Hook.	
Dictiaophyllia antiqua.	M'C. xxvi. 10.	.	*	.	.	Hook.	
Pleurodictyum problematicum.	Phil. P. F.	.	***	.	.	Lisnapaste, Clonea, Ballinacourty.	
Favosites capillaris.	Phil. G. Y.	.	.	***	.	Cornacarrow, Armagh, Annahugh.	
" fibrosa.	Phil. P. F.	.	*	**	.	Clonea, Annahugh, Killymeal.	5
" Gothlandica.	Phil. P. F.	.	**	*	.	Bundoran, Malahide, St. John's Pt.	5
" megastoma[a].	Phil. G. Y.	.	*	*	.	Poulscadden, Lackagh, Scraghy.	
" polymorpha.	Phil. P. F.	.	*	.	.	Hook, *rare.*	
" parasitica[a].	Phil. G. Y.	.	.	**	.	Termon, Armagh.	
" septosus.	Flem., Br. An.	.	*	**	.	Clonea, Armagh, Raheendoran.	
" serialis.	Port. T. 22. 6.	.	*	.	.	Hook Head.	
" spongites[a].	Phil. P. F.	.	**	*	.	Lisnapaste, Malahide, Millecent.	10
" tenuisepta[a].	Phil. G. Y.	.	**	*	.	Finner, Mohill, Howth.	
" tumida[a].	Phil. G. Y.	.	*	**	.	Kildress, Malahide, Killymeal.	5
Cannopora placenta.	Phil. P. F.	.	.	.	.	Locality lost.	
Cyathophyllum turbinatum.	Gold. T. 16. 8.	.	.	*	.	Benburb.	
" ceratites.	Port. p. 331.	.	.	*	.	Derryloran, *Clonoe.*	
" flexuosum.	Gold. Pet. T. 173.	.	.	*	.	Sligo, *Kilvarnet.*	
Stromatopora concentrica.	Phil. P. F.	.	*	**	.	Killybrone, Howth, Malahide.	
" polymorpha.	Phil. P. F.	.	.	**	.	Curkeen, Ballyduff.	
" subtilis.	M'C. xxvii. 9.	.	.	*	.	Curkeen, *common.*	
Ceriopora distans.	M'C. xxvii. 13.	.	.	*	.	Millecent. [courty.	
Verticillopora abnormis.	Lons. S. S.	.	***	.	.	Ballintrillick, Malahide, Ballina-	
" dubia.	M'C. xxvii. 12.	.	.	*	.	Cookstown.	
Flustra palmata	M'C. xxvi. 14.	.	*	.	.	Finner.	
Berenecea megastoma.	M'C. xxvi. 13.	.	*	.	.	Hook.	
Orbiculites antiquus.	M'C. xxvi. 16.	.	*	.	.	Rahoran.	
Millepora gracilis.	Phil. P. F.	.	***	.	.	Lisnapaste, Ballintrillick, Clonea.	3
" interporosa.	Phil. G. Y.	.	**	*	.	Lisnapaste, Malahide, Florence Court.	
" oculata[b].	Phil. G. Y.	.	**	*	.	Ballintrillick. Toberelathan, Howth.	
" rhombifera.	Phil. G. Y.	.	***	.	.	Lisnapaste, Carrowmably, Poulscadden.	
" similia.	Phil. P. F.		**	*		Carrowmably, Toberelathan, St.	
" spicularia.	Phil. G. Y.	.	**	.	.	Bundoran, Poulscadden. [Doulough's.	
Strombodes vermcularia.	Phil. P. F.	.	*	.	.	Benburb, *Portlock.*	
Tragos semicirculare.	M'C. xxvii. 8.	.	.	**	.	Manorhamilton, Cregg.	
Gorgonia assimilis.	Lons. S. S.	.	*	.	.	Ballinacourty.	
" Lonsdaleiana.	M'C. xxviii. 1.	.	.	**	.	Laracor, Millecent.	
" ziczac.	M'C. xxviii. 2.	.	*	.	.	Granard.	
Jania antiqua.	M'C. xxvi. 12.	.	*	*	.	Rahan's Bay, St. John's Point.	
" bacillaria.	M'C. xxvi. 11.	.	*	.	.	Lisnapaste. [agh.	
" crassa.	M'C. xxvii. 4.	.	*	**	.	Abbey Bay, St. John's Point, Lack-	
Vincularia dichotoma.	M'C. xxvii. 15.	.	.	***	.	Cornacarrow, Knockninny, Millecent.	4
" megastoma.	M'C. xxvii. 10.	.	.	*	.	Killymeal.	
" multangularis.	Port. T. 22. 7.	.	.	**	.	Dungannon, Drumglass.	
" parallela[c].	Phil. G. Y.	.	**	*	.	Carrowmably, Lisnapaste, Killymeal	
" raricosta.	M'C. xxvii. 11.	.	.	*	.	Killymeal.	
Glauconome bipinnata.	Phil. P. F.	.	**	*	.	Carrowmably, Bundoran, Blacklion.	
" gracilis.	M'C. xxviii. 5.	.	.	*	.	Killymeal.	
" grandis.	M'C. xxviii. 3.	.	.	**	.	Killymeal, Meelick.	
" pluma[d].	Phil. G. Y.	.	*	**	.	Lisnapaste, Belmore, Killymeal.	8
" pulcherrima.	M'C. xxviii. 4.	.	.	*	.	Blacklion.	
Ptylopora flustriformis[e].	Phil. P. F.	.	.	*	.	Locality lost.	
" pluma.	Sco. MSS. xxviii. 6.	.	**	*	.	Carrowmably, Malahide, Killymeal.	
Fenestella antiqua.	Phil. P. F.	.	**	.	*	Lisnapaste, Currens, Carrowmanalt.	18
" carinata.	M'C. xxviii. 12.	.	**	*	.	Benburb, Malahide, Tornaroan.	
" crassa.	M'C. xxix. 1.	.	.	***	.	Blacklion, Millecent, Ballinacourty.	
" ejuncida.	M'C. xxviii. 11.	.	.	*	.	Blacklion, *abundant.* [Island.	
" flabellata[f].	Phil. G. Y.	.	**	*	.	Bruckless, Carrowmably, Little	
" formosa.	M'C. xxix. 2.	.	**	*	.	Currens, Hook, *common*, Killymeal.	

[a] Favosites, was Calamopora.
[b] Millepora oculata, was Pustulopora oculata.
[c] Vincularia parallela, was Flustra parallela.
[d] Glauconome pluma, was Retepora pluma.
[e] Ptylopora flustriformis, was Retepora flustriformis.
[f] Fenestella, was Retepora.

NAME.	AUTHORITY.	O. R. S.	Cal. Sl.	Limest.	Coal.	LOCALITIES.	Other localities.
ZOOPHYTA—*continued.*							
Fenestella frutex.	M'C. xxviii. 10.	.	.	*	.	Killymeal.	
" hemispherica.	M'C. xxix. 4.	.	.	**	.	Millecent, Little Island.	
" intertexta	Port. T. 22. 3.	.	*	.	.	Benburb.	
" laxa.	Phil. P. F.	.	*	**	.	Clonea, Belmore, Blacklion.	
" membranacea[a].	Phil. G. Y.	.	*	**	.	Bruckless, Cookstown. Millecent.	4
" Morissii.	M'C. xxviii. 14.	.	*	**	.	Carrowmably, Millecent, Little Island.	
" multiporata.	M'C. xxviii. 9.	.	**	*	.	Carrowmably, Poulscadden, Millecent.	6
" nodulosa[a].	Phil. G. Y.	.	**	*	.	Carrowmably, Rahoran, Blacklion.	5
" oculata.	M'C. xxviii. 15.	.	**	.	.	Carrowmably, Ballinacourty.	
" plebeia.	M'C. xxix. 3.	.	**	*	.	Malahide, Hook, Little Island.	7
" polyporata[a].	Phil. G. Y.	.	**	*	.	Lisnapaste, Carrowmably, Florence Court.	
" quadradecimalis.	M'C. xxviii. 13.	.	*	*		Carrowmably, Blacklion.	
" tenuifila[a].	Phil. G. Y.	.	*	**	.	Lisnapaste, Millecent, Little Island.	
" undulata[a].	Phil. G. Y.	.	*	*	*	Malahide, St. Doulough's, Carrownanalt.	8
" varicosa.	M'C. xxviii. 8.	.	.	*	.	Blacklion.	
Hemitrypa Hibernica.	Sco. MSS. xxix. 7.	.	*	**	.	Ballintrillick, Clare, Little Island.	
" oculata.	Phil. P. F.	.	.	*	.	Blacklion.	
Ichthyorachis Newenhami.	M'C. xxix. 8.	.	.	*	.	Meelick.	
Polypora dendroides.	M'C. xxix. 9.	.	**	*	.	Killeshandra, Poulscadden, Hook.	
" marginata.	M'C. xxix. 5.	.	.	**	.	Killymeal, Blacklion.	
" papillata.	M'C. xxix. 10.	.	.	***	.	Killymeal, Blacklion, Rathgillen:	
" verrucosa.	M'C. xxix. 6.	.	.	*	.	Blacklion.	
Retepora flustriformis.	Phil. G. Y.	.	.	*	.	Florence Court.	
" irregularis.	Port. T. 22. 2.	.	*	*	.	Florence Court, Hook Head.	
" prisca.	Gold. T. 36. 19.	.	.	**	.	Ballinacourty, *in limestone*, Hook Head.	
" undata.	M'C. xxix. 11.	.	*	**	.	Lisnapaste, Millecent, Ballyduff.	

[a] Fenestella, was Retepora.

In the foregoing Table, at page 11, there are five species of Dolabra enumerated, which were got at Cultra, in the soft yellow magnesian limestone. This limestone was formerly quarried here and carried to England for manufacturing purposes, and it was out of a few blocks of it that remain on the shore the imperfect casts were got which Mr. M'Coy described, and which I believe he was told were carboniferous. Those casts do resemble the Cuculleæ of the "Palæozoic fossils," but I think they are Permian, or belonging to the Magnesian limestone. They are *Dolabra angusta*, *D. complanata*, *D. Hardingii*, *D. trapezium*, and *D. unilateralis*.

ALPHABETICAL LIST OF LOCALITIES.

ABBEYLANDS, in the county of Donegal, is about one mile N.W. of the town of Ballyshannon, on the north bank of the river Erne. The rock here is calcareous slate, and the fossils are found in abundance and variety along the shore. The black shale is interstratified with thin beds of gray limestone; some beautiful specimens of *Orthis filiaria* are found, and a few of the limestone beds contain a variety of *Orthis crenistria* (*umbraculum?*) four inches in diameter.

AGHABOY, in the county of Cavan, is situated about a mile and a quarter S.W. of Swanlinbar village. The upper part of the limestone occurs here, and there is a cave, called Pulgulm, or the Pigeon-hole, from which a subterranean mountain stream emerges, about which there are some fossils. In this cave the surface of the limestone has a high degree of polish, probably from the friction of particles contained in the muddy waters which flow through it in floods, and which flow down from the sandstone and argillaceous strata of the coal rocks.

AGHAFIN, in the Queen's County, is one mile S.W. of the village of Castletown, and four miles S.W. of Mountrath; a black calcareous slate occurs here, which is full of fossils.

AGHAMORE, in Leitrim, lies five miles S.W. of Ballyshannon, and about two miles S.W. of Bundoran. In a stream, at the western boundary of this townland, about fifteen chains south of the road, and at the base of the steep part of the mountain side, a fine black shale occurs, in the calcareous slate in which many species of shale fossils are found, such as Sanguinolites, Amphidesma, Lucina, Nucula, &c., and some of the beds have great numbers of Cythere.

AGHINTAIN, in Tyrone, is two miles west of Clogher. The fossiliferous rock is black shale, which is found in the river which flows through the townland, and in some quarries.

AGHNAGLOGH, in Tyrone, two miles N.W. of Clogher. A river runs through this townland, in which occurs a black shale in connexion with the sandstone. Some black, hard, calcareous beds are found in this, about two feet above the level of the water, at a bend in the river, in which the dithyrocarus is found, of two or more species. Farther eastward, under a high bank in the river, a black shale occurs, in which *Modiola Macadami* is abundant, as well as other small shells of the shales. The rock here lies nearly level, dipping at an angle of 3° to 5° eastward down the river, so that the same bed can be often followed for several yards in the banks of the river.

ALTEEN STREAM, in Cavan, lies one mile N.W. of Swanlinbar; both limestone and slate occur in this townland.

ALTMUSH, in Meath, is situated two miles north of the village of Nobber. The rock here is black shale in the vicinity of light gray limestone; it contains *Posidoniæ*, and other fossils of the fine black shale of the millstone grit.

ANNAGH, in Cork, is four miles S.W. of the town of Charleville, on the limestone, which is fossiliferous.

ANNAGHILLA, in Tyrone, is situated three miles S.W. of Ballygawley. The rock here is arenaceous limestone. It occurs at the road side, under about four or five feet deep of bog. The rock is excavated for lime, and for building. Also, farther N.W., some of the beds appear to be composed of a mass of shells. *Orthis crenistria* and *Orthis Kellii* are the principal, and those two fossils are easily distinguished here from each other.

ANNAHUGH, in Armagh, lies about six miles N.E. of Armagh, and two miles east of the village of Loughgall. The rock is limestone, and dips generally N.W. about 20°.

ARAGLIN BRIDGE, in Cork, is situated two miles N.E. of Fermoy. The rock is yellowish sandstone, in which black shale occurs, which contains *Cypricardia* and a few other fossils.

ARDAGH, in Meath, lies five miles south of Carrickmacross, and two miles N.W. of Drumcondra. This is a high hill of light gray limestone, beds massive, and in some places very rich in fossils. A quarry has been excavated on the road-side, at the eastern base of the hill, in which the fossilist will gain a good return for his labour. *Atrypa excavata* is abundant, though scarce, in other places. The bare rock projects in cliffs on the eastern brow of the hill, and in this, as well as in the loose stones and the fence walls, numerous species are found. This is the only locality in which *Producta striata* has been got.

ARDATRAVE, in Fermanagh, is two miles S.W. of Kesh village, on the east shore of Lough Erne. Calcareous slates interstratified with limestone beds occur here, in those rocks which lie below the main limestone.

ARDCLOUGH, in Kildare, is about eight miles from Dublin. The quarries are on the southern bank of the Grand Canal. The rock is limestone, of a dark gray colour, beds massive and very pure. Large quantities of it are brought to Dublin, and burned into lime. It is rich in fossils, among which prevail beautiful specimens of *Euomphalus pentangulatus* and *Orthoceras ovale;* also several varieties of corals, the *Fenestellæ* predominating.

ARDLOUGHILL, in Donegal, is two miles S.E. of Ballyshannon, and one mile N.W. of the village of Belleek on the river Erne. The fossils here are found in a few small excavations made in the lands, to get stones for fence walls. The rock is calcareous slate, interstratified with beds of limestone near its base. *Pleurorhyncus giganteus* is found abundant.

ARDOGINNA or ARDOE, in Waterford, lies on the coast, five miles east of Youghal, and one mile south of the village of Ardmore. There is a fine exhibition here of the strata, passing from sandstone into black calcareous slates, alternating with thin beds of limestone dipping at a steep angle towards the sea. Fossils are found in the thin beds of limestone.

ARMAGH, in Armagh County. This town lies on the junction of the Graywacké and Carboniferous formations, and red sandstone beds, with reddish limestone alternating, form the lowest part visible of the latter. Some beds of the limestone exhibit a remarkable conglomeritic character, and contain numerous angular fragments of red sandstone, and also of red limestone. The limestone in the quarries about the town, at Farmacaffly or Red Barn, and other places, contain many species of the usual fossil shells of the limestone, and also some corals, though the latter are rare. There is a remarkable similarity between the rocks at Armagh, and those at Castle Espie, on the N.W. shore of Strangford Lough, and the prevailing fossils also are common to the two places. *Orthoceras giganteum* and *Productus giganteus* are some of these.

At Armagh the remains of fishes are found in the limestone. Palates, teeth, spines, and rays, are common. The quarrymen have been taught by Captain Jones to appreciate and preserve them, and a geologist may come upon a pretty good collection of fish remains for a few shillings.

ATHENRY, ten miles east of Galway, is a small town in the middle of a country of gray limestone, which generally contains very few fossils; the most remarkable is *Lithostrotion striatum*, which is found in very fine specimens in various parts of the surrounding country, especially at Carrowntobber, two miles north of the town, where the rock is near the surface,—as it is in all this locality.

AUGHARAINY, in Fermanagh, lies about one mile south of the village of Kesh, on the road to Enniskillen. The whole country for a few miles round Kesh is composed of yellow sandstone, interstratified with black calcareous slate and limestone bands, which abound in the ordinary fossils. A search here would well repay the labour.

BALLINA, a large town, on the river Moy, in Mayo, stands on limestone, in which some fossils are got in quarries about the town.

BALLINACOURTY, in Waterford, lies three miles east of Dungarvan, on the north shore of the entrance to Dungarvan Harbour. The rock is calcareous slate, dipping to the north, and succeeded by limestone, which is of a very light gray colour, and very pure in quality, apparently one enormous massive bed, having strong and distinct traces of cleavage, but very faint of stratification. The rocks round the shore, southward from the little pier, contain a great variety and abundance of fossils; Productæ, Spiriferæ, Orthides, Atrypæ, and Pecten are found; and in the decomposing rock numerous casts of encrenite heads. Immediately south of the little quay, on the shore, *Pleurorhyncus alæformis* is abundant. This fossil is also found in similar strata at Poulscadden, and opposite the new hotel on the shore at Malahide. The beds of slate have a strong cleavage here, and in getting out fossils care must be taken to break or split the rocks along the sedimentary lines, and not on the cleavage lines.

BALLINAFAD, in Sligo, lies five miles north of Boyle, on the Sligo road. The limestone at the quarries here dip at a steep angle N.W., on the northern flank of the Curlew mountains. It is not rich in fossils.

BALLINGLEN, in Mayo, is six miles N.W. of Killala, and two S.W. of the village of Ballycastle. There is a good section of the rocks on the east side of the glen, having a strong red sandstone at the base, a yellow flaggy sandstone near the top of the hill, and limestone and shales in the intermediate space, with the outcrop of the beds in the face of the hill. Productæ of several species are found in the limestone, and Nuculæ and Cypricardiæ in the black shales; corals are scarce.

BALLINFOILE, in Galway, one mile N.E. of the town. Fossils are scarce here. *Producta hemispherica* and *Producta comoides* are found in some of the beds of gray limestone.

BALLINHASSIG, or GOGGAN'S HILL, in Cork, is seven miles S.W. of Cork City. The new road, leading to the railroad station from Ballinhassig, exposes grey arenaceous and slaty beds, which are full of obscure casts of fossils, especially encrinite stems. *Leptæna depressa* was got there.

BALLINTREE, in Dublin, is on the shore, one mile north of the village of Rush. The rock is millstone grit. A very good locality for the fossils of the black slates of this division, especially on the shore near the southern boundary of the townland.

BALLYBODONNEL, in Donegal, is ten miles west of the town of Donegal, and half a mile south of the village of Dunkineely. The rock here is composed of alternations of sandstone, limestone, and black calcareous slate, and is pretty rich in fossils.

BALLYCASTLE.—*See* TORNAROAN.

BALLYCONNEL, in Cavan, a village four miles west of Belturbet, is situated on limestone, which dips there 3° westward. The quarries are a quarter of a mile west of the town. Fossils occur, but not plentifully.

BALLYDUFF, in Waterford, is two miles west of Dungarvan. The gray limestone there is rich in fossils, and they come well out of the rock.

BALLYGASEY, in Armagh, is four miles north of the town of Armagh, and one mile east of the village of Loughgall. The limestone here dips northwards at an angle of about 20°.

BALLYHANRY, in Galway, is five miles west of Portumna. A light gray limestone occurs here, containing good specimens of *Temnocheilus* and other univalves.

BALLYHOE, in Meath, is five miles south of Carrickmacross, on the Dublin road. The rock is limestone.

BALLYKEA, in Dublin, is seven miles north of Malahide, and two miles south of Skerries. The quarries here are of light gray pure limestone, and there is abundance of fossils, which come well out of the rock; two or three species of Euomphalus are common. Millstone grit shales also occur in this townland, which are seen in a deep cutting of the Drogheda Railway, and contain Posidoniæ, and other fossils peculiar to this rock.

BALLYMACAN is in Tyrone. It is two miles S.W. of Clogher. The streams hereabouts abound with fossils, in a black calcareous slate,—scales of fishes have been found in it, as well as many of the usual fossils of the limestone.

BALLYMACELLIGOT, in Kerry, is three miles east of Tralee, at both sides of the Killarney road. Gray limestone occurs here, and a peculiar kind of flinty slate is used in repairing the roads; some fossils are found.

BALLYMAHON, in the county of Longford, is a pretty large town. The country about here is fossiliferous limestone.

BALLYMAKEAN, in Cork, is three miles south of Kinsale. This vicinity affords goniatites.

BALLYMEENY, in Sligo, is two miles S.E. of the village of Easky. The rock is rather an impure limestone, mostly in thin beds, which frequently have thin partings of shale.

BALLYNURE, in Londonderry, is four miles west of Maghera. The rock here is mostly a black calcareous shale, with some hard beds. Fish scales and bones are got in a stream in the east boundary of this townland, about ten chains up from the Moyola river, and twenty chains N.W. of the Forge Bridge.

BALSITRIC, in Meath, is three miles east of Nobber, and two miles S.W. of Drumcondra. The lower black beds of the limestone occur here with slate; and *Pleurorhyncus giganteus* is abundant in them.

BANADA, in Londonderry, is four miles north of Draperstown, on the road to Dungiven. Fossils are got here in red marly shale, of the Old Red Sandstone, in a ravine a few chains east of the road.

BANNAGHAGOLE, in Carlow, is two miles west of Leighlinbridge. The rock here is limestone, covered by the coal rocks of Castlecomer. Fossils are found abundant, and some of them, where the rock is exposed to the weather, stand out in relief, and afford fine specimens, showing the muscular impressions of the fossils and other parts very well.

BANNAGHBEG, in Fermanagh, is one mile N.W. of the village of Kesh. The Bannagh river, flowing along this townland, affords a good section through the black shales. Fish scales are found in some of the beds, especially these of *Holoptychius Portlockii.*

BANAGHER, in the King's County, is a middling town, near the Shannon, on limestone. There are some fossils in the quarries near the town.

BANTEER, in Cork, is three miles south of Kanturk. The limestone here is light gray; some beds of it appear to be almost composed of a small fossil—*Cucullea arguta;* the same is abundant at Mallow.

BELMORE MOUNTAIN, in Fermanagh, is six miles S.W. of Enniskillen. The calcareous slate on the eastern face of this mountain contains fossils abundantly, as also the limestone which surmounts it.

BENBURB, in Tyrone, is a small town, six miles N.W. of Armagh. Some precipices of limestone are exposed at the old castle, in which fossils are found. In the canal cutting on the south side of the river here, there are five bands of yellow sandstone, alternating with gray limestone and black shale. The limestone and the shale beds contain several species of Productæ.

BLACKBALL HEAD is in Cork; it is thirty miles from Bantry, on the north shore of Bantry Bay. The black slaty limestone here contains many species of fossils.

BLACKLION is in Leitrim, twelve miles W. of Enniskillen, on the Sligo road. The limestone in the vicinity of this place is rich in fossils.

BLACKROCK, in Cork, is two miles E. of the city, on the south side of the river. There are several quarries of gray limestone in the vicinity, which abound with fossils. All the fossils of the valley of Cork are distorted, both those which lie in the calcareous slaty strata of the base of the limestone, and those in the limestone itself. The limestone of this valley appears to have undergone a kind of cleavage, and the calcareous slate which lies belows it has a very distinct cleavage. This is not usual in the midland or northern counties of Ireland. The line which separates those conditions of the calcareous rocks and their fossils may be said to be the course of the river Blackwater from Cappoquin to Mallow, producing this line a few miles both ways. It is remarkable on the two sides of Waterford Harbour, that the fossils of the calcareous slates on the west side of it, about Clonea and Dungarvan, are highly distorted; while those on the east side, about Hook Head, on the same parallel, and in similar rock, are not so, or are at least but very slightly altered.

BOA ISLAND, in Fermanagh, is an island in the north end of Lough Erne. The rocks here are mostly yellow sandstone, black shale, and impure limestone, all of which contain fossils. Those of the sandstone are only casts, the calcareous portion of the fossil having been absorbed or removed.

BOHEVNY, in Fermanagh, lies on the west side of Lough Erne; it is situated one mile N.W. of the village of Churchhill. The rock is mostly black slate with thin beds of limestone, being the lower part of the limestone.

BOSTON, in Kildare, is six miles north of Kildare, and four miles east of Rathangan; fossils are plentiful in the limestone here.

BRACKAGHREILLY, in Londonderry, is two miles west of Maghera, and on the road to Draperstown. The east boundary of the townland here is a stream, and in this, a few perches north of the road, a bed of gray rock, about a foot thick, occurs in black shales at the level of the water, in which scales and bones of fish are plentiful.

BRICKEEN BRIDGE, in Kerry, is four miles south of Killarney. The calcareous slates about this place yield fossils.

BRUCKLESS, in Donegal, is eleven miles west of the town of Donegal, and one mile north of the village of Dunkineely. The rock here is composed of red sandstone, which forms the base of the Carboniferous rocks, succeeded by alternations of yellow sandstone, black slate, and thin beds of limestone. The finer beds of the slate contain a profusion of the fossils usually found in those beds, the best of which are found in a stream which flows westward through the townland, into the sea.

BUNANINVER, in the county of Fermanagh, is three miles south of the village of Kesh, on the east shore of Lough Erne. Where the shales and thin beds of limestone are exposed to the action of the water, the fossils are easily seen.

BUNATRAHIR, in the county of Mayo, is eight miles N.W. of Killala, and about a mile N.W. of Ballycastle. The rocks along the western shore of Bunatrahir Bay are well exposed, being the lowest part of the limestone subdivision of the Carboniferous series, and afford fossils in the limestones, the shales, and even here in red sandstone—a thing unusual.

BUNDORAN, in Donegal, is a bathing village, three miles S.W. of Ballyshannon; the rock here is calcareous slate, with beds of impure limestone, the strata lie nearly level, and are very well exposed. The black shales and impure limestone beds contain a profusion of fossils. In one place in the bay some beds of the rock are covered with *Orthis resupinata*, studded so closely that they resemble a pavement of stones about two inches diameter. In the west side of the bay, near low-water mark, in black fine slates, some beautifully marked Pectens are got; and near the same place, where there are rude steps made in the precipice as a passage to descend to the water, one of the upper beds of the cliff, about three feet thick, is composed almost wholly of a mass of *Orthis crenistria*.

BUNOWNA, in Sligo, is at the east side of the river at Easky, about fifteen miles N.E. of Ballina. The rock is a dark, impure limestone, and is well exposed in the river near the village, and on the shore. *Siphonophyllia cylindrica* is very abundant, and the specimens very large. Large bunches of *Lithodendrons* occur on the shore.

BURRIS, in the Queen's County, is two miles N.E. of Maryborough. The rock is light gray limestone, which abounds with the fossils usually found in this rock.

CAHERATRIM, in Galway, is three miles S.W. from Loughrea, on the north brow of the Derrybrian mountains. Slate occurs here at the foot of the hill, in a stream that runs northward, a few chains south of its junction with a larger stream running westwards. This slate is calcareous, and contains a profusion of the ordinary fossils found lowest in the series, as *Leptagonia analoga*, *Spirifer attenuata*, *Orthis crenistria*, &c. &c.

CALRAGH, in Armagh, is five miles N.W. of the town of Armagh. The rock is limestone, and dips N.W. about 10°. Indeed, the general dip of the rock for a few miles northward of Armagh is to the N.W. Productæ and Spirifera are found here.

CAPPAGHMOYLE, in Galway, lies four miles N.E. of Athenry. A light gray limestone occurs here, full of beautiful fossils, a thing unusual for miles in the limestone of the surrounding country. The rock has not been quarried, except a little used for fences; but the beds are bare at the only farmhouse on the townland, close to the bog edge, and appears to underlie an extensive bog, situated to the east. The whole country westward is calcareous slate, and the nearest dip to this is eastward, towards and under the limestone, which is a mile off.

CARLINGFORD, in the county of Louth, is a pretty large town on the south side of Carlingford Bay. Limestone is extensively quarried near the town, and contains fine specimens of fossils; *Siphonophyllia cylindrica*, *Bellerophon apertus*, *&c.*, are common. The limestone here is near the junction with the greenstone of Carlingford mountain, and is penetrated with numerous trap dykes, some cutting across others, and showing dykes of three separate epochs. Near the junction, the limestone is in some places highly crystalline, white in colour, and contains large, rudely formed garnets.

CARN, in Fermanagh, is three miles S.E. of Kesh, on the east side of Lough Erne. The rock here is all limestone, and contains fossils.

CARRICKBOY, in Longford, is five miles N.E. of Ballymahon, and about five miles S.W. of Edgworthstown. The limestone here is light gray, and very fossiliferous.

CARRICKDUFF, in Longford, is two miles north of Granard.

CARRICKOUGHTER, in Fermanagh, is two miles N.W. of Kesh; it is situated in the limestones, shales, and sandstones of this neighbourhood, which lie low in the formation.

CARRIGAHORIG, in Tipperary, is three miles S.E. of Portumna. A deep cutting for a mill-race has been made here through the rock, which leaves it well exposed. The colour is light gray, and it is very fossiliferous. *Univalves*, such as *Nautilus*, *Euomphalus*, &c., are common, and they come well out of the rock.

CARRIGALINE, in the county of Cork, is six miles S.E. of Cork; light gray limestone similar to that of the Cork valley occurs here, and contains fossils.

CARROWMABLY, in Sligo, is four miles S.E. of Easky on the sea-shore.

CARROWMACRORY, in Sligo, is six miles east of Easky, on the sea-shore. The rock here is impure limestone, and fossiliferous.

CARROWMORE, in Sligo, is four miles S.W. of Coolaney, and five miles N.E. of Tobercorry, on the west side of Knocknashee Hill. The rock is limestone, and fossiliferous.

Carrownanalt, in Roscommon, is two miles N.E. of the village of Keadue, and one mile west of Lough Allen. It is in the coal measures of that district, and about 200 feet above a bed of coal that has been worked near it. Thirty-five species of shells and trilobites were obtained in a few blackish beds, altogether about three feet thick, which are a little calcareous. Of the thirty-five species, twenty-six are found also in the gray limestone, and are, therefore, common to both, and nine species peculiar to the coal rocks. Four specimens and four fragments were got also at this place, which Mr. M'Coy thought to be new, or undescribed.

Carrowntreemall, in Fermanagh, lies ten miles S.W. of Enniskillen, on the Sligo road, and on the north shore of Lough Macnean. This is a good locality for fossils of the limestone.

Carrowntobber, in Galway, is two miles N.E. of Athenry. *Lithostrotion striatum*, which is very fine here, is the chief fossil found. Fossils are scarce in the limestone about this place.

Cartronaglogh, in Roscommon, is half a mile north of the village of Keadue, in the upper part of the limestone, and gives a pretty good variety of fossils.

Cashelboy, in Sligo, is twelve miles west of Sligo, on the Ballina road, and about half way between Skreen and Dromore west. A stream, which forms the western boundary of the townland, crosses the road near a chapel, and in this stream, four chains south of the road, is a sandstone quarry, in which there is some shale, which contains *Cypricardia rhombea* abundantly.

Castlecreagh, in Cork, is one mile east of Doneraile, where fossils are got in the limestone.

Castle Espie, in Down, is on the western shore of Lough Strangford, eleven miles S.E. from Belfast, and two miles S.E. of Comber. This limestone has a mass of beds of red sandstone over it. It is of a reddish colour, very pure. Many of the fossils of the carboniferous limestone are found here, especially very fine specimens of the *Actinoceras giganteum*, three feet long, and nine inches diameter at the thick end.

Castle Island, in Kerry, is a small town; it stands on the upper part of the limestone, which hereabouts contains in some beds a variety of fossils.

Castlerickard, in Cork, is two miles N.E. of Castlemartyr, and situated in the lower part of the limestone district of that country.

CASTLETOWN, in Meath, is four miles south of Trim. The light gray limestone here abounds in fossils.

CAVANSALLAGH, in Tyrone, is two miles N.W. of Drumquin. The limestone here has several varieties of fossils. Specimens of *Siphonophyllia cylindrica* are found, exactly like those got at Carlingford.

CHICKEN HILL.—*See* KILLMALLOCK.

CLARAGHMORE, in Tyrone, is one mile and a half N.E. of Drumquin. Casts of *Bellerophon apertus* and *Cornu arietis* occur here in beds of arenaceous limestone, which is impure and very siliceous.

CLARE, in Tyrone, is half a mile east of Cookstown. Very beautiful specimens of *Lithostrotion striatum* are found here.

CLAREVIEW, in Fermanagh, is two miles S.W. of Kesh, on the east shore of Lough Erne.

CLEEN, in Roscommon, is four miles N.E. of Boyle, and one mile from Knockvicar bridge. Arenaceous limestone occurs here, which has many of the fossils of the lower beds of the Carboniferous limestone.

CLEENISHGARVE, in Fermanagh, is an island in Lough Erne, about two miles S.W. of Kesh. The rock consists of the alternating slates and limestones of the lower part of the Carboniferous limestone.

CLIFDEN, in Clare, is one and a half miles west of Corofin, is a millstone grit locality. In the road side, in a wood, the black slaty strata are exposed, and yield *pectens*, *posidoniæ*, &c.

CLONEA, in Waterford, is three miles N.E. of Dungarvan, on the seashore. The calcareous slate, interstratified with beds of limestone, occurs here, as at Ballinacourty, and contains an abundance of fossils. The rock here, which dips 20° south, is probably the counterpart of that at Ballinacourty, which dips the reverse way, or northward, both being the lower slates and limestone beds of the valley of Dungarvan, over which rests the pure light gray limestone of Ballinacourty, Ballyduff, and the whole valley of the Blackwater, to Lismore and Fermoy. That which is shale in other localities, as at Hook Head, is here slate, from the distinct cleavage which it exhibits in this valley. All the lower and impure shales of the south of Ireland, beyond a certain line, show a cleavage, which is not seen to the north of that line, which cleavage appears to be connected with the distortion of the fossils imbedded in it. The line above alluded to extends from this place westward to Cappoquin, Fermoy, Mallow, Kanturk, Killarney, and thence to Castlemaine Bay, keeping its position chiefly along the valley of the Blackwater river, for a great part of the way.

CLOONLARA or MEELICK, in Clare, is three miles N.E. of Limerick. Very fine fossils are got here. The *Ichthyorachis Newenhami*, a new and beautiful coral, was found here by Mr. Newenham, of Dundanion Castle, Blackrock, Cork, who kindly presented it, to have a drawing and description made, as seen in Plate xxix. fig. 8, of Synopsis.

CLONKEIFFY, in Cavan, is five miles S.W. of Virgina. The lower shales and limestone here contain *Spirifer minima*, which is abundant here, but very scarce generally.

CLONTURK, in Monaghan, is three miles S.E. of Carrickmacross, and is in the limestone of that district, which is fossiliferous.

CONG, in Galway, is a village on the N.E. angle of Lough Corrib. The limestone hereabouts contains but few fossils; the *Lithostrotion striatum* is the most common. The rock in lithological character very much resembles that at Athenry. Though perhaps it may be out of place here, it may be interesting to remark that Silurian fossils are abundant on the north shore of Lough Corrib, at Ardaun, and other places.

COOKSTOWN, in Tyrone, is a small town. The north end of the town is on limestone, of a light gray reddish colour. In the quarry, a quarter of a mile west of the town, the upper part of the rock is in a decomposing condition, and the fossils come beautifully out of it.

CORICK, in Londonderry, is three miles south of Draperstown, on the east side of the White river, which affords a good section of the shale and limestone of this district. The black slates are fossiliferous. *Atrypa gregaria* is found here.

CORLAVE, in Fermanagh, is three miles N.W. of Kesh. The shales and limestones here abound in fossils.

CORNADOWAGH, in Longford, is seven miles west of Ballymahon. The limestone here affords fossils.

CORNAGRADE, in Fermanagh, lies on the east side of Enniskillen, half a mile distant. The quarry gives out some specimens Productæ and Spiriferæ. The *Orthis gibbera*, Plate xviii. fig. 9, Synopsis, has been found here, and nowhere else.

COUNTENAN, in Cavan, is four miles east of the town of Cavan, and one mile N.W. of the village of Stradone. A large quarry here, in an arenaceous limestone, affords a good variety of fossils.

COURTLOUGH, in Dublin, is three miles south of Balbriggan. A large quarry has been opened here near the base of the coal formation, which contains some of the shale fossils of that division of the Carboniferous rocks.

COVE, in Cork, now Queenstown, is a seaport town in Cork Harbour. In a black slate, immediately west of the town, *Loxoceras incomitatum* is found. It appears to me very doubtful that this slate belongs to the Carboniferous rocks.

CREGG, in Meath, is two miles north of Nobber. The limestone here has many beautiful varieties of fossils.

CREGGANORE, in Galway, more commonly known by the name of Toberelathan is on the N.W. brow of the Derrybrian mountains, six miles S.W. of Loughrea, and two furlongs east of the Gort road. There is a junction visible here, in a stream of the Old Red Sandstone, lying unconformably on the graywacke slate, and a little higher on the hill are several junctions, showing patches of yellowish conglomerate on the slate; and in some places, a few perches of the lower bed or two only; near the well called Toberélathan, in the stream, the blackish calcareous slate appears; the lowest slate of the Carboniferous rocks, which is full of the usual fossils, especially *Spirifer attenuata* and *Leptagonia analoga*.

CREVENISH, in Fermanagh, is one mile S.W. of Kesh, on the eastern shore of Lough Erne. This is a good fossiliferous district.

CROPPATRICK, in Mayo, is one mile S.E. of Killalla. The arenaceous limestone here is fossiliferous.

CRUICETOWN, in Meath, is two miles west of Nobber.

CUILMORE, in Mayo, is three miles east of Claremorris. Calcareous slate, with limestone, here has the usual fossils. Fenestellæ are abundant.

CULLEENAMORE, in Sligo, is five miles west of Sligo, on the western side of Knocknarea mountain. This place is remarkable for the abundance of specimens of *Syphonophyllia cylindrica*, which are found in the fields, as they are disintegrated by the weather from the limestone cliffs of Knocknarea, and roll down the side of the hill. Some of those are three or four inches in diameter, and the pieces a foot long; but the whole fossil, as found at Kilglass, on the sea-shore, is two feet long.

CULLION, in Londonderry, is two and a half miles S.E. of Draperstown, and five miles S.W. of Maghera. In a deep ravine on the N.E. brow of Slievegallion mountain, the lower calcareous black shale contains a great profusion of beautiful fossils, among others *Spirifer pinguis* is very abundant.

CULTRA, in Down, is on the south shore of Belfast Lough, five miles N.E. from Belfast, and one mile N.E. from Holywood. The rock here is much broken up by whin dykes. It lies on graywacke slate unconformably. One of those dykes forms the foundation of the little pier at this place, and to the west of this, the black shaly strata are well exposed at low water. About forty yards out from high water-mark, in some of the beds, the scales of fishes (*Holoptychius Portlockii*) are found very fine; and immediately adjoining the pier in the fine black shale are millions of Cytheræ, of several kinds. Similar fish scales and Cytheræ are found in the black shale band which runs across the valley of the Moyola near Maghera; and at the Bannagh river, near Kesh, in Fermanagh. From having fish remains of similar species found here as at Moyheeland, and the rock there having been supposed to be a band of black shale in the Old Red Sandstone, this was put in the same rock, it being impossible to fix its place here by visible superposition. It is very doubtful that it belongs to the Old Red. The rocks on the shore are much broken up with whin dykes, and between every two of them a rock of different aspect is brought to the surface. There are red sandstone, red shale, red thin-bedded limestone, yellow magnesian limestone, and black and gray shale, all in the space of about half a mile, between high and low water mark. Those rocks in Yorkshire and Durham would be recognised as being in the vicinity of the upper part of the Coal formation, and of them, this bit of shore is very probably the equivalent. This would make this black shale belong to the coal strata, and the fish remains here, at Moyheeland, and the River Banagh, near Kesh, would be all common to that series; indeed, beside the fish remains, those black shales and accompanying rocks in the three places just mentioned are identical in lithological character.

CURKEEN, in Dublin, is seven miles north of Malahide, and two miles south of Skerries. The quarries here, in light gray pure limestone, contain a variety of beautiful fossils.

CURRAGH, in Waterford, is one mile north of the village of Ardmore.

The road here is cut through, and shows some sections of shale, which afford specimens of the fossils usually found in those lower beds.

CURRAGHMORE, in Fermanagh, is four miles west of Kesh, on the north shore of Lough Erne.

CURRENS, in Kerry, is six miles S.E. of Tralee, on the Killarney road, and about three miles S.W. of Castle Island. This is a very fine locality for the fossils of the calcareous slate, and they are got in a state of good preservation.

CUSACKSTOWN, in Meath, is six miles S.E. of Navan, and is in the lower part of the limestone. The rocks here contain the usual fossils.

DEERPARK, in Fermanagh, is two miles S.E. of Kesh; it is a locality of the lower part of the limestone.

DERRYGONELLY is in Fermanagh, is eleven miles N.W. from Enniskillen, on the west side of Lough Erne. Casts of fossils are found here in a quarry, in a soft yellow sandstone.

DERRYLORAN, in Tyrone, is at the south end of the town of Cookstown. Alternate beds of limestown and sandstone occur here. The sandstone is generally red; but a thick bed, near the church, is of a greenish-gray colour. The limestone, like all hereabouts, is fossiliferous, some of it takes a high polish.

DERRYNACAPPLE, or DERRYNACAPPLEKEAGH, in Fermanagh, is four miles N.E. of Kesh. This is a locality of limestone, shale and sandstone alternating, with the usual fossils.

DESERTMARTIN, in Londonderry, is a small town, four miles south of Maghera. The limestone quarries here are not very fossiliferous. Fish palates have been got in them.

DONAGHRISK, in Tyrone, is two miles S.E. of Cookstown, and immediately west of the village of Tullyhog. Like Derryloran, limestone and sandstone are found here alternating. Some fossils are got in the limestone.

DONERAILE is in the county of Cork. The limestone in this locality is fossiliferous.

DOONFEENY, in Mayo, is eight miles N.W. from Killalla, and two N.W. of Ballycastle. This is a locality of the arenaceous rocks. Black shales predominate; but there are also thin beds of impure limestone. Some beds of the shale are very fossiliferous.

DOORIN, in Donegal, is seven miles west of the town of Donegal, and lies on the north side of Donegal Bay. The cliffs along the sea-coast here are very finely exposed—they are all black shale. This is a good locality for fossils. *Pleurotomaria canaliculata* is found here, and is a very scarce fossil elsewhere.

DOWNS, in Armagh, is a quarter of a mile S.W. of the town of Armagh. The limestone of this locality is of reddish-gray colour, and contains palates, teeth, and spines of fishes.

DROMARD, in Londonderry, is two miles east of Draperstown, and about five miles S.W. of Maghera. A stream which flows northward from Slievegallion along the east boundary of this townland gives a good section of the rocks. The usual Modiola and Nucula of the lower black shale are found here, and *Murchisonia elongata* is plentiful.

DRUMBRICK, in Fermanagh, is four miles N.E. of Kesh, and one and a half north of Ederny.

DRUMCURREN, in Fermanagh, is two miles N.E. of Kesh.

DRUMDOE, in Roscommon, is four miles north of Boyle, on the S.E. shore of Lough Arrow. The lower part of the limestone here is fossiliferous, and has a good variety.

DRUMGOWNA, in Fermanagh, is three miles N.W. of Kesh, in the calcareous slaty division.

DRUMKEERAN, in Fermanagh, is two miles N.E. of Kesh. These localities about Kesh are all in the shales, limestone, and sandstones, which alternate in this part of the country, and lie on the red base of the Old Red Sandstone.

DRUMLATTERY, in the county of Dublin, is on the sea-shore, two miles south of Skerries. The rock here is limestone, and fossiliferous.

DRUMMANMORE, in Armagh, is one mile N.E. of the town of Armagh. The limestone here contains a good variety of fossils.

DRUMNAGROAGH, in Donegal, is one mile S.E. of Ballyshannon. The limestone here is at the surface, and fossiliferous.

DRUMOD, in the county of Leitrim, is a village about twelve miles north of Longford, on the mail-coach road. A few perches north of the town, on the Mohill road-side, calcareous slate is found, containing abundance of fossils; and one mile N.W. of Drumod, on the Shannon shore, is yellow sandstone, and black shale, the latter containing Modiola, and other fossils usually found in that position.

DRUMOWEN, in Tyrone, is two miles west of Drumquin. The same band of limestone, containing the same fossils, crosses this townland, which is found in Drumscraw and Cavansallagh, the adjoining townlands.

DRUMREAGH ETRA, in Tyrone, is four miles N.E. of Dungannon, on the Stewartstown road. The limestone here is supposed to be of the upper part, from its immediate proximity to the Coal Island coal district.

DRUMREASK, in Fermanagh, on the west shore of Lough Erne, is one mile north of the village of Church-hill. It is a good locality for black shale fossils.

DRUMSCRAW, in Tyrone, is one mile S.W. of Drumquin. The band of gray limestone which crosses this townland contains a great variety of the usual fossils of the limestone.

DUNDONAGH, in Monaghan, is six miles north of Monaghan, and two miles S.E. of Emyvale.

DUNKINEELY, in Donegal, is a small town, ten miles west of Donegal. This is a sandstone locality, and has the usual alternations of sandstone, limestone, and shale, found at the base of the Carboniferous limestone in the N.W. parts of Ireland. The rocks mostly dip S.E. about 10°. The locality abounds in fossils.

DUNKIT, in Kilkenny, is three miles north of the city of Waterford. Large excavations have been made here in limestone; but the rock is not fertile in fossils. The calcareous slate which underlies it, and is exposed about the entrance to the quarry, yields fossils plentifully, and in a good state.

EDENACRANNON, in Tyrone, is four miles S.W. of Dungannon. The rock is the lower part of the limestone, with its interlaminated slate.

EDENASOP, in Tyrone, is five miles S.W. of Castlederg.

EDERNY, in Fermanagh, is two miles east of Kesh.

ENAGH, in Armagh, is seven miles west of Armagh; about a quarter of a mile S.E. of the village of Tynan. Teeth and spines of fishes are found in the light reddish-gray limestone, as at the Downs, near Armagh.

FALLAGLOON, in Londonderry, is two miles west of Maghera. The mountain stream which forms the east boundary of this townland exposes a good section of the Old Red Sandstone; and the black shales, about a mile up from the chapel, contains a profusion of the usual fossils of that division of these lower beds. *Axinus nuculoides* is got in whole masses; *Modiola Macadami*, and *Modiola subparallela*, abundant; seven species of Cytheræ have been got, and scales of *Holoptychius Portlockii*. A band of gray shale crosses the Moyola from this to the White river; this band is supposed to have the Old Red Sandstone under and over it. See *Moyheeland*.

FARMACAFFLY, or REDBARN, in Armagh, is one mile S.W. of Armagh, Fish remains are got in the limestone here,—palates, teeth, and spines.

FASGLASSAGH, in Tyrone, is four miles N.E. of Ballygawley. The lower black shales abound here, and contain the usual fossils.

FELLOW'S-HALL, in Armagh, is seven miles west of Armagh—a limestone locality, and fossiliferous.

FINNER, in Donegal, is three miles S.W. of Ballyshannon, on the south side of the mouth of the river Erne. The rocks are so well exposed by the action of the waves that it is an excellent locality for the fossils of this part of the series.

FLEMINGSTOWN, in Meath, is six miles west of Balbriggan, and one mile N.W. of the village of Naul. About the chapel of Clonalvy the limestone is light gray, and the fossils come out well.

FORT-WILLIAM, in Cork, is one mile and a half S.W. of Doneraile, on the Mallow road. A good limestone locality for fossils.

GLENBANE.—*See* LACKAGH.

GRANARD, in Longford, is a small town, situated on the lower shales and sandstones of the carboniferous rocks. Numerous fossils occur here.

GRANGEMORE, in Roscommon, is three miles S.W. of Boyle, and two north of Frenchpark; an extensive field of limestone spreads over this part of the country, but does not contain a great variety of fossils. *Orthis filiaria* is common.

GREAGHS, in Donegal, is three miles S.E. of the town of Donegal, and half a mile east of the village of Laghy. The fossils of the lower black shales are abundant here.

GUBBAROE, in Fermanagh, is two miles S.W. of Kesh, on the east shore of Lough Erne. This is a good locality for fossils.

GURTEENROE, in Cork, is two miles north of Bantry. The rock here is calcareous slate. No good excavation is exposed, but hummocks of slate on the road side afford crinoid stems and fenestellæ.

HOLEOPEN BAY, in the county of Cork, is six miles south of Kinsale. Goniatites, and shells much resembling Posidoniæ, are got here in black slate; the slate and the fossils much altered and distorted, apparently by metamorphic action. The kinds would suggest the idea that the slate is an altered millstone grit.

HOOK HEAD, or HOOK POINT, in Wexford, is situated on the east side of Waterford Harbour, and the shore here affords a fine section of the lower part of the carboniferous rocks. First, red conglomerates and red sandstone, with some beds of yellow in ascending southwards, and a few beds of red or blue shale; the upper part all yellow or gray, and a little calcareous, and it is in these the fossils first appear. Next comes a series of thin beds of limestone, and black shale alternating. The limestone rises in large flags, of which both sides are covered with a profusion and variety of fossils. This is on the townland of Portersgate. Over it lie yellow sandstone and calcareous gray sandstone, and this again is succeeded by thin beds and afterwards thick beds of limestone alternating with shale, for more than a mile along the shore, but nearly level. Next, towards Hook Point, the whole becomes limestone, with but a few and very thin beds of shale. In the whole peninsula, the rock is so well exposed along the sea-shore that it is one of the finest localities in Ireland for fossils. Very fine specimens of crinoid heads have been found near the Point. They are usually got in the thin beds of shale which separate the limestone beds, where the action of the waves carries away the soft matter of the shale, and leaves them standing in relief on the surface of the bed of limestone. In considering them, on the spot, the idea is suggested that they grew on the surface of a bed of limestone in the sea—as seaweed now does—that a flood came over the place, charged with sand and mud, and killed the animals, which, therefore, lay dead, and were buried in the muddy deposit left by the waters, which is usually from three to six inches thick between the beds of limestone. The heads and stems, for some feet in length, are got together, lying in these thin shale beds, and in some cases have all their fine markings beautifully shown.

HORATH, in Meath, is five miles north of Kells. The rock is the dark limestone, which lies near the base of that subdivision. Several fossils are found in it—*Bellerophon apertus* and *Pleurorhyncus giganteus* are common.

HOWTH, in Dublin, is nine miles east of Dublin. A fine quarry of limestone occurs here, the rock being also well exposed on the shore, a little to the north of the village, and contains the usual fossils.

INVER, in Donegal, is situated on the sea-coast, seven miles west of Donegal. This locality is all in black calcareous slate and shale, of the lower part of the limestone division.

KESH, in Fermanagh, is thirteen miles N.E. of Enniskillen, near the N.E. angle of Lough Erne. The development of the sandstone, to the north of this place, with its alternations of limestones and shales, is remarkable.

KILBRIDE, in Mayo, is seven miles N.W. of Ballina, and two miles N.E. of the village of Ballycastle. The rock is limestone, with its shales, and this place shows it well, being surmounted by sandstone. The place is rich in fossils. *Atrypa gregaria* occurs in masses; it has been only found here, at Ballinglen, which may be said to be part of the same series of beds, and in the White river, near Draperstown, in Londonderry.

KILCAR, in Cavan, is two miles S.W. of Belturbet. The rock here is limestone, and fossiliferous.

KILCOMMOCK, in Longford, is three miles N.W. of Ballymahon, a lower limestone locality, and fertile in fossils.

KILCUMMIN, in Mayo, is on the sea-coast, five miles N.W. of Killala. This is a locality of alternations of limestone, shale, and yellow sandstone, and contains many varieties of the fossils usually found in this position.

KILCURRY, in Louth, is four miles N.W. of Dundalk. In this locality is found red sandstone, some black shales, and some limestone, as also yellow sandstone. The shales especially have fossils.

KILDRESS, in Tyrone, is two miles west of Cookstown. In the river here is found a section of red shale, which contains the usual fossils of the black and gray calcareous shales, especially trilobites and corals, and this is the only locality where such fossils have been got in red shale. A little higher up, or westwards in the river, is found a red sandstone also, which contains abundance of casts of fossils. *Atrypa canalis* and *Atrypa laticosta* are got in this sandstone.

KILGLASS in Sligo, is eight miles north of Ballina, on the sea-shore, on the east side of Killalla Bay. The limestone is well exposed here, and affords some of the finest specimens of *Siphonophyllia cylindrica*. There are several whin dykes here, running in an east and west direction, cutting through the limestone rock.

KILLAGHTEE, in Donegal, is situated on the sea-shore, eleven miles west of Donegal, and one mile S.W. of the village of Dunkineely. This locality is in the lower shales and limestones, and the sections are well exposed by the action of the water, and contain much fossils.

KILLESHANDRA, in Cavan, is a small town. It stands on yellow sandstone, but over this lies limestone with shale, which is partially quarried, about two furlongs west of the church. This limestone contains a great variety of fossils.

KILLINAMACK, in Waterford, is three miles S.W. of Clonmel, near Knocklofty bridge. Calcareous slate occurs here at the road-side, which contains a profusion of fossils.

KILLINGLY or BALLEA, in Cork, is five miles S.E. of Cork, and two miles N.W. of Carrigaline. The calcareous slate here contains only one group of slaty beds between the yellow or upper part of the sandstone and the overlying limestone.

KILLOGUNRA, in Mayo, is two miles S.W. of Killalla. The lower shales and limestones occur here, and are fossiliferous.

KILLUKIN, in Roscommon, is about one mile S.W. of Carrick-on-Shannon. The rock is limestone, and very fossiliferous.

KILLYBRONE, in Mayo, is one mile N.W. of Killala. The fossiliferous rock here is an oolitic limestone, nearly black, and appears covered by yellow sandstone.

KILLYCLOGHY is in Fermanagh. It is about a mile and a half S.E. of Lisbellaw. A river flows down into the valley southwards, in which yellow sandstone and the accompanying shales and limestones are exposed, in which are found the usual Modiolæ, Nuculæ, &c. of the lower shales.

KILLYGREAN UPPER, in Monaghan, is about two miles N.E. of the little town of Emyvale, a locality of limestone, shale, and sandstone, the two former having fossils.

KILLYMEAL, in Tyrone, is half a mile east of Dungannon. On account of the vicinity to the coal district of Coal Island, the rock here is supposed to be the upper limestone, but there is no visible junction to verify this supposition. The quarries, which are extensive, afford a good variety of fossils, and there are some vertical cracks, which admit water from the surface, and which are in a decomposing state for two or four inches inwards from the surface of the crack, and in this part of the rock are found the most beautiful fossils, of a purely white colour, with all their most delicate markings, in a high state of preservation. The pores of fenestellæ, and the finest striæ of pectens are seen under the magnifier. *Producta latissima* is abundant here, though scarce in other localities.

KILMACDUAGH, in Clare, is five miles S.W. of Gort. Fossils are not plentiful in the limestone here.

KILMALLOCK, in Limerick, is a limestone locality. There are large quarries in the vicinity, and the usual fossils of the limestone come out in abundance, and show the markings uncommonly well.

KILMORE, in Armagh, is six miles N.E. of the town of Armagh. The dip of the limestone, which is fossiliferous here, is about 15° N.W.

KILTULLAGH, in Roscommon, is eight miles S.W. of Castlereagh. The lower part of the limestone is the rock here.

KNOCKAGH, in Louth, is three miles N.W. of Dundalk. The rock is limestone with shale, interstratified near the base of the limestone subdivision of the Carboniferous system.

KNOCKNAREA, in Sligo.—*See* CULLEENAMORE.

KNOCKNINNY, in Fermanagh, is a steep high hill, on the west side of Lough Erne, ten miles south-east of Enniskillen. The rock is a light gray limestone, and it contains here some beautiful fossils, especially Fenestellæ, on the west side, half way up the hill.

KNOCKONNY, in Tyrone, is half a mile north of Ballygawly. A yellowish calcareous slate occurs here, in a stream in which a peculiar Pecten is abundant, and no other fossil. It has been called *Pecten Knockonniensis* from this place.

LACKAGH, in Tyrone, is one mile west of Drumquin. In the low part of this townland, near the bridge, limestone occurs, which yields beautiful specimens of *Producta hemispherica.*

In the high part, or western end, is a ravine called Glenbane, in which a stream has made a deep cut in the black shale; this is one of the best localities in Ireland for fossils. I believe these black strata to be the millstone grit, or lower part of the coal formation. On the banks of this stream, if the grass and soil be dug away, near the top, the rock is soon laid bare, and this upper decomposing part of it yields the finest casts of fossils, which come out well. Where a vertical crack occurs in the rock, which has admitted water for years, the rock becomes partially decomposed, for six or twelve inches away from the opening, and this part also yields the fossils clean. The sound shale also contains them, but they cannot be got well out. There is no cleavage in the shale here, as at Ballinacourty, or other parts of the south of Ireland. The mass of the hill is composed of strata, lying nearly level.

LACKEN, in Roscommon, is three miles S.E. of Athleague. The country for many miles about this place is limestone, light gray, and unmixed with shale.

LAGHY, in Donegal, is a village four miles south of Donegal, on the Ballyshannon road. This locality is near the base of the limestone.

LANE, in the county of Dublin, is on the sea-shore, two miles S.E. of Skerries. The limestone rock is well exposed here. An area of some acres of it on the surface between high and low-water mark is dolomite.

LARACOR is in Meath, two miles south of Trim. Light gray limestone occurs here, and contains a good variety of fossils.

LARAGH, in Cavan, is six miles east of Cavan, and one mile north of Stradone. In this place is a basin of the lower part of the Carboniferous rocks, comprising sandstone, shales, and limestone, resting on the graywacke slate of the surrounding country. Fossils are found here.

LARGANMORE, in Mayo, is fourteen miles west of Crossmolina, and four miles west of Corick bridge. Immediately north of the Belmullet road rises a series of beds of black shale, with a few beds of impure blackish limestone. A great variety of the black shale fossils, as Modiolæ, Nuculæ, Cypricardiæ, Cytheræ, &c., are found here. These shales are over the Old Red Sandstone.

LEAM is in Fermanagh, two miles east of the village of Tempo, and three miles west of Fivemiletown. The Manyburns river flows here through the lower shales, and affords sections which yield the usual fossils. *Cypricardia socialis* is found in great abundance.

LECK is in Monaghan, two miles north of Glasslough, is on limestone which contains fossils.

LISARDREA is in Roscommon, two miles S.W. of Boyle. This is a limestone locality, but not very fossiliferous.

LISMORE, in Tyrone, is half a mile S.W. of Clogher. All the strata here are fossiliferous, up to the sandstone which lies south of Clogher.

LISNAPASTE is in Donegal, five miles south of the town of Donegal, and one mile and a half S.E. of the village of Laghy. About three furlongs south of the village of Ballinakillew is a little bridge, and the bed of the stream that flows through it is on black shale, which affords fossils of great variety, and of great beauty. A few chains south of this bridge, on the road-side, is an excavation made for repairing the roads, and the shale or slate here yields millions of fossils; this shale is calcareous, lying over the Old Red Sandstone, and at the base of the limestone.

LITTLE ISLAND is in Cork, four miles east of the city. The limestone here is light gray, and very pure, and contains abundance of fossils, of those usual in the lower limestone in other parts of Ireland, with this difference—that they are in general distorted, as are all the fossils in the limestone of this county, and also in the county of Waterford, and part of Kerry. If a line be drawn upon the map of Ireland, from Waterford to Kanturk, and produced from Kanturk to Killarney, all the fossils south of this line are distorted, both in the slates at the base of the limestone and in the limestone itself. This circumstance is likely to have some connexion with the violent convolutions and steep dip of the strata apparent in this part of the country, while it is quite otherwise in the midland counties, where the strata lie level, or nearly so. South of this line also, the soft black strata, which in the northern counties are shale, here deserve the name of slate, from superior hardness and distinct cleavage; even the massive limestone has strong cleavage lines.

MAGHERANORE, in Sligo, is two miles east of the small town of Tobercorry. The limestone here has fossils, especially Lithodendrons, and other corals.

MAGHERENNY, in Tyrone, is one mile S.E. of Drumquin. The limestone here is impure and siliceous, and belongs to the lower portions of the formation; it contains some fossils. *Bellerophon cornuarietis* is found here.

MALAHIDE is in the county of Dublin, nine miles N.E. of the city. The rock here is calcareous slate, of which the limestone and shales are well exposed on the sea-shore, and yield a great variety and abundance of fossils. Opposite the new hotel, under high-water mark, is found *Pleurorhyncus aliforme*, which also occurs in rocks of similar lithological character at Poulscadden, and at Ballinacourty. *Pleurorhyncus fusiformis* is almost peculiar to this locality, only one other specimen having been found at Hook.

MANORHAMILTON is a small town in the county of Leitrim. Half a mile S.E. of the town there is a mill, and the stream which works it flows westward through black shale at the base of the limestone, which yields a good variety of fossils. The limestone occurs here also.

MEELICK CHAPEL, Clare.—*See* CLONLARA.

MEENCARIGAGH, in Tyrone, is five miles S.E. of the town of Castlederg, on the Pettigo road. The black shale here affords a good variety of fossils.

MIDDLETON is a small town, thirteen miles east of Cork. The gray limestone hereabouts contains the usual fossils, well preserved.

MILLECENT, in Kildare, is four miles north of Naas. The limestone here affords a profusion of fossils, and, as it is taken to Dublin by canal for economical purposes, those fossils have become better known than those of most other localities. Some of the beds appear to be formed of a mass of organic matter, which still contains many undescribed forms.

MILTOWN MALBAY, in Clare, is on the western coast. About the town the rock is of the coal-measures of that county.

MILVERTON, in the county of Dublin, is one mile S.W. of Skerries. The light gray limestone of this place yields numerous varieties of fossils. *Euomphalus rotundatus* is plentiful.

MOHILL is in Leitrim. The rock is calcareous slate hereabouts, and contains many varieties of fossils.

MONADUFF is in Longford, six miles N.E. of Newtownforbes, and one mile N.E. of the village of Drumlish, at the southern base of Cairnclonhugh mountain. The limestone and calcareous slates of this locality afford the usual fossils of the lower beds, and, in addition, some beautiful spines and scales of fishes.

MONAGHAN is the chief town of the county of that name. The quarry at the infirmary is a gray limestone, very siliceous; it dips northward from the graywacke slate hills. It is of the lower beds. It contains *Orthis crenistria*, and *Orthis Kellii*, but no other fossils were got in it at this place.

MONEYNEANY, in Londonderry, is seven miles west of Maghera, and four N.W. of Draperstown. A stream, which crosses the Dungiven road, forms the barony bounds here, and some red and purple shales overlying the Old Red Sandstone afford a few of the fossils found in the black shales.

MOORE, in Roscommon, is three miles east of Ballinasloe. The light gray limestone of this district produces abundance of fossils.

MORERA, in Leitrim, is four miles S.W. of Manorhamilton, on the Sligo road. Here, near the junction with the mica slate of Benbo mountain, fossils are found in the limestone and shale.

MOYHEELAND, in Londonderry, is five miles S.W. of Maghera. The village of Draperstown stands on part of this townland. On the south bank of the Moyola river, a few yards above the forge bridge, very fine specimens of fish remains are got in a bed of black shale, at about the summer level of the water. Scales of *Holoptychius Portlockii*, spines of Gyracanthus, and numerous large bones, were obtained; also a tolerably perfect specimen of a whole fish, somewhat farther up in the river, in a bed of black shale near the north bank. The black shale and slate in the Moyola at this place is part of a band which crosses the valley from Fallagloon on the N.E. by the forge bridge, to the White river on the S.W., being two to three miles long, and about a quarter of a mile wide. This band was supposed to be in the Old Red Sandstone, because that rock occurs to the west of it, and white sandstone to the east, at Gortahurk and other places, succeeded by gray mountain limestone near Desertmartin, all dipping the same way, eastward. The same species of fish remains occur in the black band ironstone near Glasgow, in the coal district there; and this circumstance, together with the colour and general lithological character of the shale itself, seems to be a presumption that this Moyola band of black shale is of the coal formation, and not belonging to the Old Red Sandstone. If so, it must be a mass which slipped down between two parallel faults, a circumstance not uncommon, and especially probable in a neighbourhood beset with dislocations. It has the basaltic protusions about Maghera covering it on the north-east end, and is terminated by the great greenstone of Slieve Gallion on the south west. Besides all this, a red sandstone covers this gray band, near the north end in the Fallylea river, which I believe to be the New Red Sandstone. This rock often covers the coal formation, where that occurs, in all the country lying west of Lough Neagh, in its vicinity. *See* CULTRA.

MOYMORE is in Clare, seven miles east of Ennis, and two miles S.W. of the village of Tulla. The limestone about here affords many species of fossils, in a high degree of preservation.

MUCKRUSS, in Kerry, is three miles south of Killarney. Calcareous slate is got here, full of the usual fossils.

MULLAGH, in the county of Meath, is three miles north of Kilcock. The black shale of this locality abounds with the usual fossils of that subdivision of the formation.

MULLAGHBOY is in Monaghan, two miles east of the village of Emyvale. Fossils are abundant at this place.

MULLAGHFARRY, in Mayo, is one mile S.W. of Killala. The black shale and limestone abound with fossils in this locality.

MULLAGHFIN is in Meath, eight miles S.W. of Drogheda, and two miles west of Duleek. The limestone here is light gray, very fossiliferous, and the fossils come out of the rock in good preservation. Several species of Martinia, Reticularia, and Spirifera, are got here. There is one thick bed of limestone, composed altogether of a mass of *Spirifer Urii*, or *Spirifer unguiculus*, as it was called. Here also was got a specimen of *Producta maxima*, as large as a man's head.

MULLAGHTINNY is in Tyrone, half a mile east of Clogher. Here the black shales, in a stream that flows down the hill northward, afford a good display of the fossils usually found in it. Modiola, Nucula, Axinus, &c., are abundant, and the specimens good.

MULLALISS, in Monaghan, is two miles east of Emyvale. This locality contains many species of Producta, and other fossils in the limestone.

MULLAWORNIA, in Longford, is two miles N. W. of Ballymahon. Here is a pretty large hill of limestone, with fossils, on the bank of the Royal Canal.

MULLYLUSTY, in Monaghan, is four miles S.W. of Carrickmacross. This is a limestone locality, but not very rich in fossils.

MULNAHUNCH, in Tyrone, is five miles S.W. of Dungannon. The rock is limestone, and fossiliferous.

NENAGH is in Tipperary. There are quarries in the limestone, half a mile west of the town, in which fossils are got.

NEWCASTLE, in Tipperary, is eight miles east of Clogheen. The rock is dark-coloured slate, and fossiliferous.

OLD LEIGHLIN is in Carlow, seven miles S.W. of Carlow, and two miles west of Leighlinbridge. The limestone occurs here, and at its junction with the overlying millstone grit of the Castlecomer district, fossils are numerous, and some beautiful casts are found in old excavations, where the flinty limestone has been exposed to the weather.

OLDTOWN is in Dublin, one mile and a half N.W. of Swords. The limestone, of a light gray colour, shows itself here, and contains a good variety of the usual fossils. *Euomphalus pentangulatus* is abundant.

OUGHTERDRUM is in Fermanagh, three miles S.E. of Belleek, and six S.E. of Ballyshannon. The limestone occurs here, and is, as usual, fossiliferous.

PAGET PRIORY, in the townland of Mullagh, is four miles north from Kilcock. It is a locality of black slates of the millstone grit, and contains Posidoniæ and Goniatites.

POULSCADDEN, in the county of Dublin, comprises a little of the shore and rocks at low water, immediately south of Howth Harbour. The rock is calcareous slate, and has abundance of the usual fossils. The beds under high water are decomposed for nearly a foot inwards from the surface, and the fossils come beautifully marked out of them.

PRUGHLISH, in Tyrone, is three miles west of Drumquin. This is a black shale district, in millstone grit, which contains the usual fossils abundantly.

RAHAN'S BAY is in Donegal, on the sea-shore, one mile S.W. of Dunkineely village. The rocks here are exposed to the action of the waves, and yield an abundant supply of fossils. There are sandstone, some limestone, and much black shale.

RAHEENDORAN, in Carlow, is four miles S.W. of Carlow. The upper part of the limestone here yields some fossils. It is extensively quarried for tombstones and architectural work. One of the beds contains *Producta hemispherica* and *Producta comoides*, and the quarrymen call this the half-moon bed. Other fossils are found, but not plentifully.

RAHORAN, in the county of Tyrone, is two miles north of Fivemiletown. The fossils of the black shale here are got out in the finest state of preservation, and are very abundant. *Pterinea*

Thompsoni, a scarce fossil, is very plentiful here, and many new species. They are got in the bed of a stream which runs southward at this place.

RATHCLINE is in Longford, about one mile south of Lanesborough. This is all a limestone country, and yields a variety of fossils.

RATHGILLEN is in Meath, two miles north of Nobber. The limestone of this place contains a good variety of fossils.

RATHMOYLE, in Roscommon, is five miles south of Frenchpark. The limestone of this district yields some fossils: *Orthis filiaria* and some others are got in a good state of preservation.

REDBARN, in Armagh, is in the townland of Farmacaffley, a mile S.W. of the town. The limestone here yields fish remains of many species, similar to those found at Castle Espie and other places.

RING, in Fermanagh, is two miles N.E. of Enniskillen. A dark limestone here, which is interstratified with shale, contains many varieties of those fossils which are usual in the lower beds of limestone, as *Leptagonia analoga, Orthis crenistria*, &c. &c.

RINGASKIDDY, in Cork, is eight miles S.E. of Cork, on the shore, at the west side of Cork Harbour, opposite Spike Island. The calcareous slate, which is found here, yields a profusion of fossils.

RINGSTOWN is in the Queen's County, one mile and a half N.E. of Mountrath. Calcareous slate occurs here, which is full of the usual fossils. A limekiln was built here of the slaty rock, and when it had been in use some time was thrown down, and the calcareous slate, from the operation of the fire, gave out the fossils in the most beautiful state of preservation, often turned white, showing the most delicate markings of both corals and shells.

ROSCOMMON, in the county of Roscommon, is the chief town of the county. It stands on limestone of a light gray colour, which contains but few fossils. *Euomphalus cristatus* was got here in the quarries, half a mile west of the town.

ROUGHAN, in Tyrone, is four miles N.E. of Dungannon, on the Stewartstown road. There is much confusion in the stratification here, but the limestone, from its close proximity to the coal strata, is supposed to be of the upper part: it contains some fossils.

ROUNDWOOD is in the Queen's County, three miles N.W. of Mountrath. The calcareous slate of this place contains the usual fossils, and in abundance.

Rush, in the county of Dublin, is a village on the sea-shore, sixteen miles N.E. of Dublin, and seven N.E. of Malahide. This is a calcareous slate locality, and the rocks on the shore are well exposed; but it may be said of them generally that they contain very few fossils. The rocks in some places are very much contorted. Towards the south, near the village, there are a few beds of limestone in the black slaty rock, and there is one place, half a mile north of the village, where a bed of pure gray limestone, about nine inches thick, contains many of the fossils peculiar to the gray limestone; but to the north of this place, for a mile, no fossils were found.

Salmon, in Dublin, is three miles south of Balbriggan. The quarries here are in light gray pure limestone, like that at Milverton and Ballykea, and contain a variety of fossils.

Scariff, in Clare, is a small town, eight miles N.W. of Kilaloe, and nineteen miles east of Ennis. The town stands in a limestone valley, which runs east and west. The rock is fossiliferous.

Scraghy, in Tyrone, is six miles S.W. of Castlederg. This is a locality of shales, sandstones, limestones, and *ironstones*, and contains many fossils.

Shanbally, in Cork, is five miles S.E. of the city, and one mile S.W. of Monkstown. The calcareous slate here is full of fossils.

Shean, in Fermanagh, is on the west shore of Lough Erne, less than a mile north of the village of Churchhill. Black slate, which here comes in contact with a greenstone dyke, contains corals, which are all turned white near the dyke, but of the usual colour of the rock at a few yards distant.

Shrule, in Longford, is four miles N.E. of Ballymahon. This is a limestone and a fossiliferous locality.

Slane, in Meath, is a small town. Half a mile east of it are limestone quarries, which afford the usual fossils.

Spierstown, in Donegal, is two miles east of the town of Donegal, and north of the Londonderry road. The limestone and shales which occur at the base of the carboniferous limestone are found here, and contain fossils. *Athyris depressa* is got here plentifully.

St. Doulough's, in Dublin, is five miles N.E. of the city, on the Malahide road. A large limestone quarry is opened here. Over it is seen the base of the black flags and shales dipping southwards 10° to 20°. Under the limestone, in the centre of the quarry, an extremely fine-grained black shale or slate is found, which contains Productæ, Pectens, and other fossils, on which are seen the most beautiful and delicate markings under the magnifier. This must be the calcareous slate. The usual fossils occur in the limestone. Encrinite stems are most abundant in some of the upper beds. *Spirifer pinguis*, a fossil generally scarce, is abundant here.

ST. JOHN'S POINT, in Donegal, is on the north coast of Donegal Bay, fourteen miles N.W. of Donegal, and four miles S.W. of Dunkineely. The Point here is limestone, but the peninsula inwards is composed of the lower rocks along the shore; on both sides of this peninsula the rocks are unusually well exposed, and fossils abundant.

STREAMHILL is in Cork, three miles north of Doneraile, at the south base of the Galtee mountains.

STREEDAGH, in Sligo, is on the coast, ten miles N.W. of the town of Sligo. The lowest beds of the limestone occur here, and are well exposed. *Siphonophyllia cylindrica* occurs in great abundance, and very large specimens. A man might walk on the bed of the rock, stepping from specimen to specimen of this fossil for several hundred yards. The fossil is above two feet long, and two to three inches in diameter.

SWANLINBAR, in Cavan, is ten miles S.W. of Enniskillen. This locality has both calcareous slate and limestone, as also millstone grit.

SWELLAN, in Cavan, is about a mile N.W. of the town of Cavan. The rock is calcareous slate, and has some fossils. They are, however, rather scarce.

SWINEFORD, in Mayo, is a small town. It is on limestone, which is not extensively quarried hereabouts, but contains the usual fossils where it is seen.

TANKARDSTOWN, in the county of Cork, is six miles N.E. of Doneraile, and one and a half miles N.W. of Kildorrery. It is in a limestone locality, and very good fossils are got in it.

TERMON, in Roscommon, is half a mile west of Boyle. There is a geological peculiarity in this place. The calcareous shale appears to be wanting. In the Termon quarry the beds of gray limestone are seen resting on yellow sandstone directly. These lowest beds of limestone contain a profusion of *Orthis papillionacea* and *Orthis crenistria*, with but few other fossils.

TINNEKILL, in the Queen's County, is three miles N.E. of Mountmellick, on the Grand Canal banks. This is a fossiliferous limestone locality.

TINNYCAHILL, in Donegal, is two miles east of the town of Donegal, on the south side of the Londonderry road. The rock here is composed of limestone beds, with black shale interstratified. The limestone beds contain a variety of the fossils usually found in the lower divisions of the carboniferous limestone, as *Orthis crenistria*, *Leptagonia analoga*, &c.

TIRLICKEN, in Longford, is three miles N.W. of Ballymahon, on the banks of the Royal Canal. The limestone here is fossiliferous, and yields good specimens of Nautilus, Temnocheilus, &c. &c.

TOBERORY, in Roscommon, is two miles N.W. of the village of Tulsk on the French parkroad. The limestone here is oolitic, and contains a good variety of fossils.

TONYELIDA, in Monaghan, is three miles north of Carrickmacross, on the mail-coach road-side. Good specimens of *Producta hemispherica*, and other fossils, are got here in the limestone.

TONYSHANDENNY, in Monaghan, is two miles N.E. of Emyvale. This locality is on the lower part of the limestone, and yields fossils.

TORNAROAN, in Antrim, is on the sea-shore, one mile and a half east of Ballycastle. There are two beds of limestone here, under high-water mark, which dip south 8°, and contain fossils. The coal district of Ballycastle lies immediately over those beds, which, if that be millstone grit, would put them in the position of the upper part of the limestone; but they are indeed very unlike the appearance of this rock in other localities in Ireland. From the description given of the Scotch coal rocks about Burdiehouse, they appear to be almost identical with the Ballycastle coal district, and the fossils, both shells and fish remains, got lately in the Scotch coal rock, are the same as those found in the lower shales in the Irish carboniferous rocks, as at Cultra, Draperstown, Drumlish, Kesh, &c.

TUBERELATHAN.—*See* CREGGANORE.

TULLYARD, in Armagh, is one mile north of the town of Armagh. The limestone here is fossiliferous.

TULLYNAGAIGY is in Fermanagh, one mile and a half S.E. of Kesh. It is a lower limestone locality, interstratified with calcareous slate.

TULLYORAN, is in the county of Leitrim, one mile east of Mohill. The rock is limestone, light gray, and very fossiliferous.

TUMPHER is in the county of Tyrone, one mile S.W. of Stewartstown. The limestone has some beds of shale in it, which contain corals of various species. *Astrea crenulare* is got in very fine specimens.

USSAUN, in Leitrim, is half a mile west of Mohill, a little to the north of the road, in a stream; the black shale affords abundance of fossils of great variety and beauty.

WALTERSTOWN, in Meath, is seven miles S.E. of Navan. It is a millstone grit locality, and in the black shale are found three or four species of Posidonia.

WESTPORT is a small town in the county of Mayo. Gray limestone occurs near the town, in a large quarry, which contains some fossils.

WHITE RIVER, in Londonderry, near Draperstown.—*See* CORICK.

WHITING BAY is in the county of Waterford, two miles east of Youghal, and nine miles south of Dungarvan. The calcareous slate here affords numerous species of fossils, mostly in the state of casts, as is the case with all the slate fossils of the counties of Waterford and Cork, at least near the surface, where the slaty rocks have been partially decomposed.

LIST OF SEVERAL POST-TOWNS, WITH FOSSIL LOCALITIES IN THEIR VICINITIES.

ARDMORE.—Ardoe, Curragh.

ARMAGH.—Annahugh, Ballygasey, Benburb, Calragh, Downs, Drummanmore, Enagh, Farmacaffly or Redbarn, Fellows' Hall, Kilmore, Tullyard.

ATHENRY.—Cappaghmoyle, Carrowntobber.

ATHLEAGUE.—Lacken.

BALBRIGGAN.—Courtlough, Flemingstown, Salmon.

BALLINA.—About the town. Bunowna, Kilbride, Kilglass.

BALLINASLOE.—Moore.

BALLINHASSIG.—Goggan's Hill.

BALLYCASTLE, *Antrim*.—Tornaroan.

BALLYCASTLE, *Mayo*.—Ballinglen, Bunatrahir, Doonfeeny, Kilbride.

BALLYCONNELL.—Quarries near the village.

BALLYGAWLEY.—Annaghilla, Fasglassagh, Knockonny.

BALLYMAHON.—Carrickboy, Cornadowagh, Kilcommock, Mullawornia, Shrule, Tirlicken.

BALLYSHANNON.—Abbeylands, Aghamore, Ardloughil, Drumnagroagh, Oughterdrum.

BANAGHER, *King's County*.—About the town.

BANTRY.—Blackball Head, Gurteenroe.

BELFAST.—Cultra.

BELLEEK.—Oughterdrum.

BELTURBET.—Ballyconnel, Kilcar.

BENBURB.—About the old castle, and in the canal banks.

BLACKLION.—Fossiliferous limestone abounds here.

BLACKROCK, *Cork*.—The limestone hereabouts is fossiliferous.

BOYLE.—Ballinafad, Cleen, Drumdoe, Grangemore, Lisardrea, Termon.

BUNDORAN.—The rocks on the shore adjoining. Aghamore.

CARLINGFORD.—In the quarries near the town.

CARLOW.—Old Leighlin, Raheendoran.

CARRICKBOY.—On fossiliferous limestone.

CARRICKMACROSS.—Ardagh, Ballyhoe, Clonturk, Mullylusty, Tonyelida.

CARRICK-ON-SHANNON.—Killukin.

CARRIGAHORIG.—The limestone cutting in the mill-race abounds in fine fossils.

CARRIGALINE.—Limestone fossiliferous. Killingly or Ballea.

CASTLEDERG.—Edenasop, Meencarigagh, Scraghy.

CASTLE ISLAND.—Fossils are found in the limestone about this place.

CASTLEKNOCK.—Quarries near the village.

CASTLEMARTYR.—Castlerickard.

CASTLEREA.—Kiltullagh.

CASTLETOWN, *Queen's County*.—Aghafin.

CAVAN.—The quarries near this have a few fossils. Countenan, Laragh, Swellan.

CHARLEVILLE.—Annagh.

CHURCHILL.—Bohevny, Shean.

CHURCH-HILL.—Drumreask.

CLANE.—Millecent.

CLAREMORRIS.—Cuilmore.

CLOGHEEN.—Newcastle.

CLOGHER.—Aghintain, Aghnaglogh, Ballymacan, Lismore, Mullaghtinny.

CLONMEL.—Limestone fossiliferous. Killinamack.

CLOONE.—*Co. Leitrim*.

COLLOONEY.—*Co. Sligo*.

COMBER.—Castle Espie.

CONG.—The limestone hereabouts has fossils.

COOKSTOWN.—Fossils occur in the quarries about the town. Clare, Derryloran, Donaghrisk, Kildress.

COOLANEY.—Carrowmore.

CORK.—The limestone in the vicinity has fossils. Carrigaline, Cove or Queenstown, Killingly, Little Island, Middleton, Ringaskiddy Shanbally.

COROFIN.—Clifden.

CROSMOLINA.—Larganmore.

DERRYGONELLY.—*Co. Fermanagh.*

DONEGAL.—Ballybodonnel, Bruckless, Doorin, Dunkineely, Finner, Greaghs, Inver, Killaghtee, Laghy, Lisnapaste, St. John's Point, Spierstown, Tinnycahill.

DONERAILE.—The limestone hereabouts fossiliferous. Castlecreagh, Fortwilliam, Streamhill, Tankardstown.

DRAPERSTOWN.—Banada, Corick, Cullion, Dromard, Moneyneany, Moyheeland, White River.

DROGHEDA.—Mullaghfin.

DROMOD.—Calcareous slates, fossiliferous; a few perches north of village.

DROMORE WEST.—Cashelboy, Carrowmably, Carrowmacrory.

DRUMCONDRA.—Ardagh, Balsitric.

DRUMLISH.—Monaduff.

DRUMQUIN.—Cavansallagh, Curraghmore, Drumowen, Drumscraw, Glenbane, Lackagh, Magherenny, Prughlish, Scraghy.

DUBLIN.—Ardclogh, Cloghran, Malahide, Rush, St. Doulough's.

DULEEK.—Mullaghfin.

DUNCANNON.—Hook Point or Hook Head.

DUNDALK.—Kilcurry, Knockagh.

DUNGANNON.—Drumreagh Etra, Edenacrannon, Killymeal, Mulnahunch, Roughan.

DUNGARVAN.—Ardoe, Ballinacourty, Ballyduff, Clonea, Curragh, Whiting Bay.

DUNKINEELY.—Ballybodonnel, Bruckless, Killagtee, Rahan's Bay.

EASKY.—Ballymeeny, Bunowna, Carrowmacrory, Carrowmably.

EDERNEY.—A pretty good locality.

EDGEWORTHSTOWN.—Carrickboy.

EMYVALE.—Killygrean Upper, Mullaghboy, Mullaliss, Tonyshandeny.

ENNIS.—Moymore, Scariff.

ENNISKILLEN.—Belmore Mountain, Blacklion, Carrowntreemall, Cornagrade, Derrygonelly, Florence Court, Knockninny, Ring.

FERMOY.—Araglin Bridge.

FETHARD, *Wexford.*—Hook Point or Hook Head.

FIVEMILETOWN.—Rahoran.

FRENCHPARK.—Rathmoyle.

GALWAY.—Athenry, Ballinfoile.

GLASSLOUGH.—Leck.

GORT.—Kilmacduagh.

GRANARD.—The calcareous slates about the town. Carrickduff.

HOLLYWOOD.—Cultra.

HOWTH.—Quarries, Poulscadden.

KANTURK.—Banteer.

KEADUE.—Carrownanalt, Cartronaglogh.

KELLS.—Horath.

KESH.—Ardatrave, Augharainy, Bannaghbeg, Bunaninver, Carn, Carrickoughter, Clareview, Cleenishgarve, Corlave, Crevenish, Curraghmore, Deerpark, Derrynacapple, Drumbrick, Drumcurren, Drumgowna, Drumkeeran, Ederny, Gubbaroe, Tullynagaigy.

KILCOCK.—Mullagh or Paget Priory.

KILDARE.—Boston.

KILDORRERY.—Tankardstown.

KILLALA.—Ballinglen, Bunatrahir, Crosspatrick, Doonfeeny, Killybrone, Kilcummin, Killogunra, Mullaghfarry.

KILLARNEY.—Brickeen Bridge, Muckross.

KILLESHANDRA.—Quarries near the town.

KILMALLOCK.—Chicken-hill.

KINSALE.—Ballymakean, Hole-open Bay.

LAGHEY.—Greaghs, Lisnapaste.

LANESBOROUGH.—Rathcline.

LEIGHLIN BRIDGE.—Bannaghagole, Old Leighlin.

LIMERICK.—Cloonlara or Meelick.

LISBELLAW.—Killycloghy.

LOUGHGALL.—Annahugh.

LOUGHREA.—Caheratrim, Cregganmore or Toberelathan.

MAGHERA.—Ballynure, Cullion, Desertmartim, Dromard, Fallagloon, Moneyneany, Moyheeland.

MALAHIDE.—Along the shore. Curkeen, Rush, Ballykea, Feltrim.

MALLOW.—In the quarries south of the town.

MANORHAMILTON.—Morera.

MARYBOROUGH.—Burris.

MOHILL.—About the town. Tullyoran, Ussaun.

MONAGHAN.—Dundonagh.

MOUNTMELLICK.—Tinnekill.

MOUNTRATH.—Aghafin, Ringstown, Roundwood.

MOYNALTY.—Horath.

NAAS.—Millecent.

NAUL.—Flemingstown.

NAVAN.—Cusackstown, Walterstown.

NENAGH.—About the town.

NEWTOWNFORBES.—Monaduff.

NOBBER.—Altmush, Balsitric, Cregg, Cruicetown.

PETTIGO.—Boa Island.

PORTUMNA.—Ballyhanry, Carrigahorig.

RATHANGAN.—Boston.

ROSCOMMON.—About the town.

RUSH.—Ballintree, Ballykea, Curkeen.

Scariff.—Quarries in the valley.
Skerries.—Ballykea, Curkeen, Drumlattery, Lane, Milverton, Salmon.
Slane.—At quarries.
Sligo.—Cashelboy, Culleenamore or Knocknarea, Streedagh.
Stewartstown.—Has limestone quarries around. Tumpher.
Stradone.—Countenan, Laragh.
Strokestown.—Toberory.
Swanlinbar.—Aghaboy, Alteen.
Swineford.—Is on limestone.
Swords.—Oldtown.
Tempo.—Leam.
Tobercorry.—Carrowmore, Magheranore.
Tralee.—Ballymacelligot, Currens.
Trim.—Castletown, Laracor.
Tulla.—Moymore.
Tullyhog.—Donaghrisk.
Tulsk.—Toberory.
Virginia.—Clonkeiffy.
Waterford.—Hook Head, or Hook Point, in County Wexford, Dankit.
Westport.—Quarries near the town.
Youghal.—Ardoe, Whiting Bay.

ADDENDA.

Since the first of the foregoing sheets was put to press, it was found that a number of fishes, got in the Irish mountain limestone, and mostly from Captain Jones's Collection, have been described by Mr. Frederick M'Coy, in the Annals of Natural History for 1848. They are enumerated in the following list:—

NAME.	AUTHORITY.	O. R. S.	Cal. Sl.	Limest.	Coal.	LOCALITIES.
Asteroptychius semiornatus.	M'C. A. N. H.	.	.	*	.	Armagh.
Asterolepis verrucosa.	M'C. A. N. H.	.	.	*	.	Armagh.
Chelyophorus Griffithii.	M'C. A. N. H.	.	*	.	.	Cultra.
Chomatodus denticulatus.	M'C. A. N. H.	.	.	*	.	Armagh.
„ obliquus.	M'C. A. N. H.	.	.	*	.	Armagh.
Cladodus lævis.	M'C. A. N. H.	.	.	*	.	Armagh.
Coccosteus carbonarius.	M'C. A. N. H.	.	.	*	.	Armagh.
Colonodus longidens.	M'C. A. N. H.	.	.	*	.	Armagh.
Cosmacanthus carbonarius.	M'C. A. N. H.	.	.	*	.	Armagh.
Ctenacanthus denticulatus.	M'C. A. N. H.	.	*	.	.	Drumlish.
„ distans.	M'C. A. N. H.	.	.	*	.	Armagh.
Dipriacanthus falcatus.	M'C. A. N. H.	.	.	*	.	Armagh.
„ Stokesii.	M'C. A. N. H.	.	.	*	.	Armagh.
Erismacanthus Jonesii.	M'C. A. N. H.	.	.	*	.	Armagh.
Glossodes lingua-bovis.	M'C. A. N. H.	.	.	*	.	Armagh.
„ marginatus.	M'C. A. N. H.	.	.	*	.	Armagh.
Gyracanthus obliquus.	M'C. A. N. H.	.	*	.	.	Moyheeland.
Helodus appendiculatus.	M'C. A. N. H.	.	.	*	.	Armagh.
„ rudis.	M'C. A. N. H.	.	.	*	.	Armagh.
Homacanthus macrodus.	M'C. A. N. H.	.	.	*	.	Armagh.
„ microdus.	M'C. A. N. H.	.	.	*	.	Armagh.
Isodus leptognathus.	M'C. A. N. H.	.	*	*	.	Moyheeland.
Nemacanthus priscus.	M'C. A. N. H.	.	.	*	.	Armagh.
Orodus compressus.	M'C. A. N. H.	.	.	*	.	Armagh.
„ porosus.	M'C. A. N. H.	.	.	*	.	Armagh.
Osteoplax erosus.	M'C. A. N. H.	.	*	.	.	Cultra.
Physonemus arcuatus.	M'C. A. N. H.	.	.	*	.	Armagh.
Platycanthus isosceles.	M'C. A. N. H.	.	.	*	.	Armagh.
Polyrhizodus pusillus.	M'C. A. N. H.	.	.	*	.	Armagh.
„ magnus.	M'C. A. N. H.	.	.	*	.	Armagh.
Psammodus canaliculatus.	M'C. A. N. H.	.	.	*	.	Armagh.
Psammosteus granulatus.	M'C. A. N. H.	.	.	*	.	River Banagh, near Kesh.
„ vermicularis.	M'C. A. N. H.	.	*	.	.	Fallagloon.

THE Society met on the 13th of June, 1855, on which occasion the following Paper was read.

NOTES ON THE CLASSIFICATION OF THE DEVONIAN AND CARBONIFEROUS ROCKS OF THE SOUTH OF IRELAND. BY J. BEETE JUKES, ESQ., AND J. W. SALTER, ESQ.

THE authors, during the last month, had examined some of the principal sections in the south of Ireland, where the base of the Carboniferous rocks and the upper part of the Old Red Sandstone are to be seen: paying especial attention to the palæontological evidence. They have arrived at the conclusion, that it is impossible to separate the so-called "Yellow Sandstone" of the south from the Old Red Sandstone, on account of their physical union alone. The upper part of the Old Red Sandstone has, interstratified with the *red* sandstones, shales, and slates, certain beds of green and yellow shales, slates, and sandstones; and in these green and yellow shales, wherever they occur, and however deep down in the Old Red, are found remains of plants, chiefly *Knorria dichotoma* (Haughton), along with which are certain linear plants, generally branched, often with marks of a central pith, and bearing on the whole a stronger resemblance to succulent roots than to any other portions of vegetables. These are, probably, the *Filicites dichotoma* of Professor Haughton. In two places, namely, at Kiltorkan Hill, near Thomastown, and at Tivoli Villa, near Cork, large shells, *Anodon Jukesii* (Forbes), have been found with these plants, but no other mollusca have, as yet, been discovered in these beds. In both these localities, as also in others farther west, the *Cyclopteris Hibernica* is found abundantly. A species, or perhaps two, of Stigmaria, is not uncommon, but there appears to be no undoubted evidence of the occurrence of Sigillaria or Lepidodendron, although the scales of fructification of a Lycopodiaceous plant have been found both at Kiltorkan and near Cork. The "Yellow Sandstone," with these characters, forms the upper part of the Old Red Sandstone all along the south of Ireland, from the Hook in Wexford to the shores of Bantry Bay.*

* This "Yellow Sandstone" is obviously distinct in many lithological characters, as well as in fossils, from the Yellow Sandstone of the north of Ireland, as described by Dr. Griffith, that of the north being undoubtedly the base of the Carboniferous system there.

Above this "Yellow Sandstone," which, perhaps, will be best called Upper Devonian, comes the Carboniferous Slate, a series of dark-bluish gray, sometimes black, slate, frequently interstratified with hard gray grits. This group is very thin towards the east, but thickens out westwards to very large dimensions, being not less than 5000 feet on the shores of Bantry Bay. The lower part of this mass forms a sub-group of hard thick gray grits, interstratified with black slates, which have been called "Coomhola grits," from a valley near Glengariff, where they are well seen. The thickness of this subordinate group, at Coomhola and Glengariff, is about 3300 feet. The Coomhola grits differ but very little from those of the Upper Devonian. The colour of the Coomhola grits, however, is generally a purer gray, while those of the Devonian have a slight greenish tinge. The only physical characters by which it is possible in all cases to separate the two groups are the occurrence of black slate partings in the Coomhola, or Carboniferous grits, and their absence from those of the Old Red Sandstone, whether upper or lower, in which the slates between the gritstones are green, yellow, pale gray, and almost all colours except black.

The fossils in the upper portion of the Carboniferous slate do not differ, except in the absence of certain forms, from those of the Carboniferous limestone. The most usual forms are Fenestella, probably the *F. plebeia*, and Encrinites, species of the genera Actinocrinus, Platycrinus, and Poteriocrinus, and even Rhodocrinus, identical with those of the Hook limestone and the Carboniferous shales of Pembrokeshire. With these, *Spirifer disjunctus* (Sowerby), and *Spirifer cuspidatus*, occur in great numbers, so that they may be considered the characteristic shells of the formation, and they are very often accompanied by *Orthis filiaria*, *Strophomena crenistria*, *Athyris squamosa*, a species of Productus, and everywhere by the *Rhynconella pleurodon*. A smooth species of Orthoceras, a Nucula, and the *Modiola M'Adami*, occur. In certain localities, especially near Cork, the latter shell is very abundant.

The grit beds in the Carboniferous Slate, and especially in the lower part of it, are usually covered with annelid tracks, and many of them are permeated throughout by small branched fucoids. The nature of these is doubtful, and they may be merely worm tracks, but they are well worthy of notice from their great abundance, and from their being equally characteristic of the Lower Limestone shales in Pembrokeshire.

In the western part of the county of Cork, as at Dunworley Bay, Dirk Bay, and, near Skibbereen, the Coomhola grits contain a very remarkable assemblage of fossils. Together with some species of Actinocrinus, identical with those from the Carboniferous rocks, *Rhynconella pleurodon*, *Spirifer cuspidatus*, and *Spirifer disjunctus* (or at least the variety of that Spirifer which is commonly called *Spirifer Verneuilli*), there have been found numerous bivalve shells, most of them of new species, and some of them apparently of undescribed genera. These shells belong to Modiola, Cucullæa, Avicula, Aviculopecten, Axinus, Nucula, and a new genus for which the name of Curtonotus (Salter) is proposed. The latter is peculiarly characteristic and abundant; it is also found on the same horizon in Pembrokeshire and North Devon. Bellerophon, rounded, sharply keeled, and trilobed species, with spiral shells and Orthoceras, and a new Lingula of large size, are not unfrequent. The Cucullææ are large, and appear to be distinct species from those of North Devon; but the *Avicula Damnoniensis* is identical with the English species, and *more abundant in the above localities than any other shell.* The *Rhynconella pleurodon*, both of large and small size, is also very abundant.

In the section of the Glen of Coomhola, and along the shores near Glengariff, these beds are better exposed, and more accessible, than in any other spot. A close search in them discovered abundance of the shells above mentioned, at least of the characteristic Avicula, and also the *Cucullæa trapezium* of Devonshire. Nor were the plants absent, for large specimens of the *Knorria dichotoma* occurred at intervals throughout the Coomhola grits, as well as in the shales of the Upper Devonian below them.

The evidence, therefore, so far as it has yet been collected throughout the south of Ireland, would point to the following conclusions:—

First, that no marine remains are to be found in the "Yellow Sandstone" of the south of Ireland, which is the upper part of the Old Red Sandstone, but that the same species of plants are found throughout it wherever there are green shales or slates, or yellowish sandstones, present in it.

Second, that the Carboniferous slate, whether more or less developed, contains, throughout all its upper portion at least, the ordinary Carboniferous types; as long ago stated by Dr. Griffith.

Thirdly, that a considerable, but locally developed group of sandstones, more or less interstratified with black or dark gray slate, intervenes between these two series, physically more connected with the base of the Carboniferous system, but palæontologically distinct. This group contains the characteristic plants of the Upper Devonian, and some at least of the shells of the Carboniferous limestone, together with numerous species, especially of the Avicula and Cucullæa, peculiar to itself. Some facts, not yet fully worked out, would indicate a still closer connexion with the Carboniferous Fauna.

These beds, whether they be eventually identified with the typical Yellow Sandstone of Dr. Griffith, as developed in the north of Ireland, or whether that may be more truly represented by the Carboniferous slate above them, may still remain as a separate group, either as lowest Carboniferous, or uppermost Devonian. In the meantime the authors prefer to leave them under the designation, in the south of Ireland, of the Coomhola grit series. They are clearly the equivalents of the Marwood sandstone of Sedgwick and Murchison, a group which has been recently shown by one of the authors to underlie the Carboniferous slate of North Devon.*

As an instance of the partial and local development of these rocks, the authors describe the great change to be found in them in the Kenmare Valley, only ten miles north of Glengariff, in a straight line. At Roughty Bridge there is not a greater thickness than 50 or 60 feet between the red slates and sandstones of the upper Old Red, and the solid crinoidal limestones of the Carboniferous limestone. These 50 or 60 feet consist of dark gray slates above, and thick gray and greenish grits below, the very uppermost beds of slate having calcareous courses and fossiliferous bands, the organic remains in which are true Carboniferous fossils. This diminution in thickness in the Carboniferous slate group, from 5000 to 50 or 60 feet in the course of ten miles, is not an apparent diminution, the result of faults and dislocations, but a real one. The beds are all excellently shown in several convolutions round a small separate trough of limestone, distinct from the main mass of limestone of the Kenmare Valley, which little trough runs for about half a mile east of Roughty Bridge, as shown by Mr. W. S. Willson in his recent survey of the ground.

P. S. March, 1856.—Since the above was written, the authors are more decidedly inclined to look on the locally developed group,

* Journal, Geol. Soc. London: Anniversary Address, 1855.

above described under the designation of Coomhola grits, as undoubtedly Carboniferous; and, therefore, on the *Avicula Damnoniensis*, the Cucullææ, and the other shells, as Carboniferous species. The Knorria and some other plants occur in these beds, as well as in those below them, namely, the variegated series of the upper part of the Old Red Sandstone, to which, so far as is yet known, the *Cyclopteris Hibernica* and the Anodon are confined.

THE Society met on the 12th of December, 1855, on which occasion the following Paper was read.

ON THE OCCURRENCE OF PERMIAN MAGNESIAN LIMESTONE AT TULLYCONNEL, NEAR ARTREA, IN THE COUNTY OF TYRONE. BY PROFESSOR WILLIAM KING, QUEEN'S COLLEGE, GALWAY.

AT the Belfast Meeting of the British Association, held in 1852, I read a short paper "On the Permian Fossils of Cultra," which was hastily got up from an inspection of some specimens in the collection of my friend, Mr. James M'Adam, of Belfast, who kindly placed them at my disposal for description.

Cultra is situated near Hollywood, on the south shore of Belfast Lough.

At the time my paper was read, I was simply aware that the Cultra beds yielding the "Permian fossils" had been described by Mr. James Bryce as of the same age as the magnesian limestones of the north of England; and that Dr. Griffith, on the contrary, considered them to belong to the Carboniferous System; but I was not acquainted with any of their published papers on the subject.

Several months afterwards, on reading over Mr. Bryce's pamphlet, prepared for the occasion of the Belfast Meeting of the British Association, and entitled, "Geological Notices on the Environs of Belfast, the East Coast of Antrim, and the Giant's Causeway" (1852), I saw for the first time an account of the "Permian Strata of Cultra."* About the same period I also became acquainted with

* Op. cit., pp. 20-22.—Since writing the above I have received from Mr. M'Adam, part iii., vol. I., of the Journal of the Geological Society of Dublin, 1837, containing Mr. Bryce's first paper, entitled, "On the Magnesian Limestone and Associated Beds which occur at Hollywood, in the County of Down," and read April 8, 1835.

the abstract of Dr. Griffith's paper "On the Lower Portion of the Carboniferous Limestone Series of Ireland," published in the British Association Report of the Cork Meeting, held in 1843. It appears by this paper, that Dr. Griffith had previously considered the Cultra beds as belonging "to the New Red Sandstone and Magnesian Limestone group;"* but from a re-examination of them a short time before the meeting, he became "decidedly of opinion" that they are coeval with certain carboniferous beds in the valley of Ballinascreen. In the abstract, the Cultra beds are described as consisting of "fine-grained red and bright yellow calcareous sandstone, containing some beds of bright yellow fossiliferous dolomite, containing casts of *Cucullæa complanata*, *C. unilateralis*, *C. Hardingii*, *C. trapezium*, *Pullastra antiqua*, with Nucula, Cypricardia, and some obscure univalves."† It is necessary to observe, that most of these names belong to fossils previously described by Mr. J. de C. Sowerby, and found in the Old Red Sandstone (Upper Devonian) of Marwood, in North Devon. The identification of the Cultra fossils with upper Devonian types will somewhat explain why my determination of their being Permian, as announced at the Belfast Meeting, met with some opposition.‡

The Cultra fossils noticed in my paper were *Schizodus Schlotheimi*, *Pleurophorus costatus*, and *Bakevellia antiqua*.§ As regards the identifications given in Dr. Griffith's paper, I have no doubt, if the fossils on which they were made were re-examined, that they would be found to agree with the Permian species just named. Mr.

* I find this opinion expressed in Dr. Griffith's Anniversary Address delivered at the Fifth Annual Meeting of the Geological Society of Dublin, and published in the Journal above quoted. Reviewing Mr. Bryce's paper, the Doctor observes:—"This limestone has been long known, though not hitherto described; it is peculiarly interesting as being the only locality in Ireland in which magnesian limestone has been discovered immediately underlying the New Red Sandstone; and though its area is small, still, its geological position is important, and deserves consideration."—*Journal of the Geological Society of Dublin*, vol. I., part iii., page 146.

† Report of the British Association for 1843, Cork Meeting, part ii., page 46.

‡ From a statement made by Mr. Kelly in his paper "On Localities of Fossils of the Carboniferous Limestones of Ireland," recently published in the Journal of the Geological Society of Dublin, vol. VII., part i., page 23, it appears that my principal opponent at the Belfast Meeting, Professor M'Coy, named the Cultra fossils in Dr. Griffith's list. (March 12, 1856.)

§ Report of the British Association for 1852, Belfast Meeting, part ii.

Binney, of Manchester, who examined the Cultra deposit in question, in 1852, has lately published a paper "On the Permian Beds of the North-West of England." Briefly noticing the geology of Cultra, this gentleman observes:—"However, past Cultra landing-place there is, beyond all doubt, as good a magnesian limestone as any in Yorkshire, containing shells of the genera Schizodus and Bakevellia."*

The determination which I came to as to the age of the Cultra "fossiliferous dolomite" is remarkably confirmed by the occurrence in county Tyrone of a perfectly analogous deposit, the relative position of which clearly proves it to belong to the Permian System.

My attention was first drawn to this deposit on accidentally seeing, in August last, a small collection of fossils in the Dublin Museum of Irish Industry, unnamed, but labelled as having been found "near Artrea, county Tyrone."† As the specimens were under lock in a glass-case I could not examine them sufficiently; but feeling convinced that they were true Permian species, I resolved on visiting, at my earliest opportunity, the locality indicated on the label.

In September last I went down to Artrea, and after a little trouble succeeded in finding the deposit I was in search of exposed in a small quarry a few yards square, at about a hundred yards or so north of the road leading from Artrea to Annaghone, where it passes along the northern base of Tullyconnel Hill. The deposit consists of a well-characterized magnesian limestone, of a yellowish brown colour and a somewhat gritty feel,‡ closely agreeing in these respects with the magnesian limestone occurring on the coast of Durham. It also corresponds with much of the Zechstein dolomite in Germany.

My attention was drawn to the quarry by some magnesian limestone blocks in an old wall on the road side adjoining a dilapidated

* Memoirs of the Literary and Philosophical Society of Manchester, vol. xii.

† Mr. Jukes informs me that the late Professor E. Forbes placed the Artrea fossils in the Museum by themselves, with a label "Permian?" This label, however, entirely escaped my notice.

‡ It is occasionally of an oolitic texture, and contains small portions of quartz, seldom exceeding half an inch in size. Mr. Jones, to whom I sent portions of the limestone containing the remains of Entomostraca for examination, remarks:—"It is curious to observe the quartz grains in the rock, and how sometimes they become partially coated, like the nuclei of the minute oolite grains."

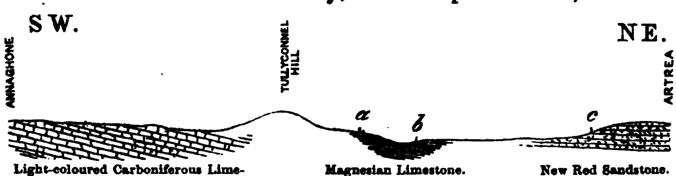
cottage. This quarry is the only place where I observed the rock *in situ;* but Mr. Slorne, who lives on the opposite or south side of the Hill, informed me that the same limestone was formerly worked immediately adjacent to the dilapidated cottage. I think it was from the latter place that Mr. Slorne procured a large number of stones built into the front wall of his house, and crowded with one or two species of fossils.

About a mile to the north of the quarry, and just before ascending the hill on which the rectory of Artrea is situated, some beds of a dark red freestone are worked, evidently a portion of the so-called "New Red Sandstone," which forms so much of the surface rock in the north of Tyrone.

Returning to the south, Tullyconnel Hill itself is so masked with drift, that I was unable to ascertain the nature of its constituent rock; but the general impression in the neighbourhood is, that it consists of a freestone similar to that which occurs near the rectory of Artrea—a view somewhat countenanced by the occurrence of a bed of deep-red freestone at the bottom of a well in Mr. Slorne's yard. Several blocks of this rock were lying about the mouth of the well at the time of my visit.

At Annaghone, situated about a mile further south on the road leading to Stewartstown, beds of carboniferous limestone, with several of its characteristic fossils, are exposed, dipping to the north-east, at an angle of about 17 degrees.

Owing to so small a portion of the magnesian limestone being visible, there is a difficulty in ascertaining its inclination; but as it lies in the direction of the dip of the carboniferous limestone beds at Annaghone, there cannot be any doubt of the latter passing under the former, as represented in the annexed section. Respecting the red freestone near Artrea rectory, I have represented it, in accord-



Section from Annaghone to Artrea.

a. The dilapidated cottage adjoining the road leading from Artrea to Tullyhog.
b. Site of the magnesian limestone quarry situated in Mr. Beatty's field.
c. Quarry of red freestone at the base of the hill near Artrea.
N. B.—The section does not extend to the Annaghone quarries and limekiln; merely to an outcrop of Carboniferous Limestone on the road, a little to the north of them.

ance with the views of Griffith and Portlock, as " New Red Sandstone," and consequently overlying the magnesian limestone; but the former may really be older than the latter, in which case it would have to be considered as equivalent to the "Rothe-todte-liegende" of the Germans. According to this view, the magnesian limestone would be a mere patch reposing in a hollow of the red sandstone. The section does not take into account the freestone bed found in Mr. Slorne's well, as the locality is a little too east of the line. As to whether or not Tullyconnel Hill consists of a similar freestone, I candidly confess my inability to come to any positive conclusion on the matter. I am in hopes, however, that Mr. M'Adam, who is at present working out the geology of the Artrea and surrounding districts, will succeed in obtaining sufficient data to enable him to settle the question.

The absence of coal-measures (a patch of which occurs near Annaghone, not much more than a mile to the south of Tullyconnel) in the section may be attributed to denuding agents having removed them before the deposition of the magnesian limestone; but I cannot refrain from hazarding the suggestion, that there runs through Tullyconnel Hill an enormous fault, which has thrown down the carboniferous limestone, coal-measures, and magnesian limestone far below their original level. A somewhat similar phenomenon occurs at Cullercoats and Whitley, on the coast of Northumberland, a little north of the Tyne, where the celebrated ninety-fathom dyke has thrown down the " Rothe-todte-liegende," marl slate, and magnesian limestone; thus preserving these members of the Permian System as an outlier, wedged in among the coal-measures.

With the exception of Colonel Portlock's " Report on the Geology of the County of Londonderry, and of parts of Tyrone and Fermanagh," 1843, I have not been able to consult any works referring to the geological structure of the Artrea district. Probably Dr. Griffith may have noticed it in some of his Reports. In his Geological Map of Ireland, however, the district in question has the colouring of " New Red Sandstone," which leads me to suppose that the " fossiliferous dolomite" has been overlooked, or included in the Saliferous System.

Colonel Portlock's " Report" contains a notice which evidently refers to the Tullyconnel Permian deposit. Speaking of the coal-measures and mountain limestone of Annaghone, the Colonel observes :—" And a little to the north, geologically overlying the limestone, there is a remarkable yellow vesicular sandstone, the true relations of which cannot at present be determined."* I have no doubt this passage refers to the magnesian limestone of Tullyconnel; and that through some mistake it has been called a "sandstone;" or, perhaps its grittiness and a hasty examination of it may have given rise to the idea of this deposit being an arenaceous rock. That there is an error in the passage quoted appears evident; for in the Geological Map appended to Colonel Portlock's "Report," the district of Tullyconnel is coloured pale-yellow, and marked "3 A 1," signifying a calcareous rock associated with the carboniferous strata. Furthermore, the Colonel elsewhere refers to Tullyconnel as being a townland "in which limestone may be procured" for economical purposes, "though at present obtained in other localities."† I have every reason for supposing that this oversight or inadvertency has arisen in consequence of Colonel Portlock having been suddenly called on to close his Report, from his services being required in another quarter.

The fossils from "near Artrea," in the Museum of Irish Industry, I have been informed, were collected by one of the officers assisting Colonel Portlock in his survey.

The Tullyconnel magnesian limestone so closely resembles that with which I have been familiar from my very childhood, that I felt no difficulty whatever in recognising fragments of it in the old wall; and no sooner had I applied my hammer to them than several specimens of fossils, with which I was perfectly acquainted, lay before me. Having worked at the Zechstein fossils in the heart of Germany, and having made those occurring in Durham an especial study, my feelings may be imagined when I first saw their exact representatives in a district forming the almost westernmost boundary of Europe.

As I was little more than an hour in the neighbourhood of Tullyconnel, doubtless all the species which occur there did not fall under my notice; but most of the specimens I collected are in such a state of preservation, that I have little doubt the determinations I have made of them will be found to be for the most part correct. On acquainting Professor Jukes with my discovery, he at once took a lively interest in it, and kindly forwarded to me for examination all the specimens in the Museum of Irish Industry. This has

* Op. cit., p. 583. † Op. cit., p. 674.

enabled me to examine some examples in a more perfect condition than any of my own. The Museum specimens do not represent so many species as occurred to me; I have, however, added to the collection all the desiderated forms belonging to myself.

I now purpose noticing the Tullyconnel fossils; but I have in the first place to express my obligations to the Council of the Society for enabling me to give representations of all the species—a kindness which has necessarily caused an outlay exceeding the sum usually allowed in such cases.

1. SPIRILLINA PUSILLA* = *Serpula pusilla*, *Geinitz*.—Pl. i., fig. 12 a, b; Monograph, pl. vi., figs. 7–9, and pl. xviii., fig. 13 a, b, c, d.†

This singular fossil has lately been ascertained by Mr. T. Rupert Jones to be a species of Spirillina,—a genus of the Agathistegian group of Rhizopoda. He purposes describing it more fully on some other occasion. All the specimens that have occurred to him are casts, which consist of an oblong coil of subcylindrical wire-like folds. A central irregularly twisted mass, of about $\frac{1}{50}$ inch in diameter, is inclosed in eight or more outer folds, which are flat or slightly concave on their internal surface, and convex externally; they are arranged longitudinally, not all on the same plane, but, with the exception of the outermost folds, cross each other at the extremities of the coil at nearly right angles. The size of the folds gradually increases from within outwards, but it is subject to irregularities, and frequently the folds are contracted where they bend over the ends of the coil. The species, probably, was free and unattached.

A very pretty specimen was found in the Tullyconnel limestone, having one or two more folds than any of those figured in my Monograph, and with the outer folds more regularly arranged on one plane.

It is of frequent occurrence in the Magnesian limestone of Humbleton Hill, near Sunderland. Geinitz found it in the Zechstein of Corbusen, in Germany; and M. Robert Eisel, Jun., informs me, that it occurs at Gera, in the Grauer Mergel-zechstein, which there overlies the great fossiliferous Zechstein.

2. FAVOSITES MACKROTHII, *Geinitz*.—Pl. i., fig. 10, a, b; Monograph, pl. iii., figs. 3–6.

This is a small branching coral, the branches consisting of numerous slender, round, or polygonal transversely wrinkled tubes, rising perpendicularly in the centre, and afterwards suddenly curving out to the surface.

The specimens of this fossil occurring at Tullyconnel, where it appears to be

* I am indebted to my friend Mr. T. Rupert Jones for an account of this fossil and the *Cythere inornata*. He has also kindly supplied me with the figures representing them.

† This reference is to my "Monograph of the Permian Fossils of England," 1850, published by the Palæontographical Society.

not uncommon, show that it often grew over the surface of dead shells, forming a basal stratum, out of which rose up, here and there, a few plume-like branches. Of the two specimens represented under fig. 10 a, the slender one appears to have attached itself to the inside of a *Mytilus squamosus*, and the other to the outside of another shell. The specimen figured at 10 b shows very distinctly the arrangement of the tubes, as displayed on a longitudinal section magnified.

None of the specimens exhibit the transverse plates and septal foramina characteristic of the genus, as represented in pl. iii., fig. 6, of my Monograph, which is to be regretted; inasmuch as some additional evidence seems to be required to prove that the species belongs to the genus Favosites. Messrs. Edwards and Haime consider it to belong to Chætetes.

Favosites Mackrothii is rather common in the Permians of Durham and Germany.

3. Thamniscus dubius = *Keratophytes dubius, Schlotheim.*—Pl. i., fig. 11; Monograph, pl. v., figs. 7–12.

A single fragment, little more than a quarter of an inch in length, is all that I have found of this Hornera-like fossil; but it is distinct enough to enable me to make the present identification. The genus *Thamniscus* is a low, irregularly-branching Bryozoon, the branches of which bifurcate irregularly: they are celluliferous on one side; while the other consists of a plate serving as a base for the cellules. In the species under consideration, the cellules are arranged in rows, of which there are from three to six on the branches. The Tullyconnel specimen is a portion of a branch, apparently divided at one (the upper) end, and exhibiting casts of three rows of cellules. *Thamniscus dubius* occurs in the Permians of Durham and Germany.

4. Mytilus squamosus, *J. de C. Sowerby.*—Pl. 1., figs. 3 a, and 36; Monograph, pl. xiv., figs. 1–7.

This fossil might at first glance be considered as having a close resemblance to some small varieties of the common mussel of our coasts; it is, however, very distinct, being inequivalved, having a widish furrow for the reception of the cartilage, and a septum in the umbonal cavity of both valves. The last character is always exhibited in good casts, which show an impression of it at the anterior termination of the hinge, as in fig. 3 a. The specimen referred to shows the posterior adductor muscular impressions, and a portion of the pallial scar. Some specimens are wider than others; but all the varieties may be easily distinguished from another Permian species—the *Mytilus septifer*—apparently only found in the North of England.

This fossil is abundant in the Tullyconnel magnesian limestone: some of the stones in the front wall of Mr. Slorne's house are crowded with specimens, many of which are an inch and a half long, the largest I have seen. It is a characteristic species of the Permian rocks of England (Durham), Germany, and Petchora land in Russia.

5. Bakevellia antiqua = *Avicula antiqua, Münster.*—Pl. i., figs. 4 a, b, c, d; Monograph, pl. xiv., figs. 28–34.

This species has much the aspect of an Avicula, to which many palæontologists have referred it; specimens, however, have occurred to me completely proving it to possess characters diagnostic of a new genus, having some relation to Modiola, and merely a similitude to Avicula. Thus Avicula possesses only one adductor muscle, whereas Bakevellia has been furnished with two, the impressions of which are displayed on the specimen (cast) represented, twice the natural size, under figure 4 c: they are also visible, but not so clearly, in the specimen figured at 4 b. The two muscular impressions are connected by a simple pallial scar, exhibited in figure 4 c. The dental characters, which consist of two elongated teeth—one on each side of the umbone—are well displayed in the cast represented under fig. 4 b. The genus possesses a cardinal area, with three or more cartilage pits (as in Gervillia, Catillus, &c.), which are exhibited in the specimen last referred to.

Bakevellia antiqua is rather tumid, inequivalve; seldom having its hinge line exceeding three-quarters of an inch in length: the surface of the valves, as shown by their impressions, is marked with rather prominent lines of growth, or striæ, parallel to the margin.

This species is rather common at Tullyconnel and Cultra. It also occurs in the Permians of Durham, and the neighbourhood of Manchester. Mr. Binney found "casts of Bakevellia"—probably the same species—along with "Schizodus, and other shells," in the magnesian limestone at Barrow Mouth, between St. Bees' Head and Whitehaven in Cumberland.* It is a characteristic fossil in Germany and Russia. Other four species are known to occur in the Permian system. The genus is also represented in the carboniferous and saliferous rocks; the so-called *Avicula socialis*, common in the Muschelkalk, is a Bakevellia.

6. PLEUROPHORUS COSTATUS = *Arca costata*, *Brown*.—Pl. i., figs. 5 a, b; Monograph, pl. xv., figs. 18, 20.

This shell is the type of an equivalved genus, first proposed in my Monograph, having some relation to Cardita. It is furnished with two diverging cardinal teeth in both valves, and one elongated posterior tooth in the right valve. The specimen represented under figure 5 a, is a cast of the right valve exhibiting the groove (a ridge in the cast) into which the posterior tooth of the right valve fitted; but it does not display so clearly the impressions of the cardinal teeth, which, however, are distinctly seen in one or two specimens before me. The anterior adductor muscular scar (in the present species deeply excavated) is bounded posteriorly by a ridge, the impression of which, as well as that of the muscular scar, are seen at * in the same figure.

Pleurophorus costatus is oval, and very inequilateral: it is generally ornamented with three or more ribs, running from the umbone to the posterio-ventral margins, and with a number of raised lines, running parallel with the free

* "On the Permian Beds of the North-west of England," vol. xii., Memoirs of the Literary and Philosophical Society of Manchester.

edge of the valves, as exhibited in the impression under figure 5 b, which is about twice the natural size.

This is not a rare species in the Tullyconnel limestone: it also occurs at Cultra, and in the neighbourhood of Manchester. In Durham, Germany, and Petchora-land, it is a characteristic Permian fossil. The genus belongs to the Carboniferous, Permian, Saliferous, and Jurassic Systems.

7. Schizodus Schlotheimi = *Cucullæa Schlotheimi, Geinitz.*—Pl. i., fig. 6; Monograph, pl. xv., figs. 31, (?) 32.

This species, which was first described from specimens occurring in the Zechstein of Germany, belongs to an extinct genus closely related to Bronn's Myophoria. Schizodus is equivalved, and possesses cardinal teeth arranged on the plan of those characteristic of Trigonia, but neither longitudinally grooved, nor so massive as in the last genus. It differs from Myophoria principally in the large tooth of the left valve being forked or bifurcated, like the corresponding tooth of Trigonia: in Bronn's genus this tooth is massive. Schizodus, I suspect, characterizes the Carboniferous, Permian, and Saliferous Systems. Myophoria appears to have had a longer geo-chronological range, since it occurs in Devonian strata and the three succeeding systems,—some of the so-called Cucullæas (or Dolabras, M'Coy) of the Marwood sandstone, (Upper Devonian) being of the genus. Goldfuss's *Megalodon truncatus*, which I am disposed to consider as closely related to, or even identical with, Sowerby's *Cucullæa angusta*, *C. unilateralis*, and *C. trapezium*, is, I strongly suspect, a species of Myophoria. The Marwood fossils, it is said, are inequivalved; but I suspect this is only apparent, arising from distortion or unequal compression.

Schizodus Schlotheimi is rather strongly inequilateral, a little tumid, rounded anteriorly, and somewhat tapering posteriorly, with an oblique truncation. All the specimens that have fallen into my hands are in the state of casts; I am therefore unable to speak of its external characters, except that the surface of the valves is nearly smooth, and marked on the anterior slope with a few faint wrinkles, impressions of which, owing to the thinness of the shell, are exhibited on the two specimens figured. An allied species, *Schizodus truncatus*, has occurred to me with marks of colouring still preserved—dark spots on a light ground, somewhat similar to the pattern exhibited on the recent *Circe Castrensis*.

This is the species which I strongly suspect has given rise to the identifications in Dr. Griffith's list under the names *Cucullæa unilateralis*, *C. complanata*, *C. trapezium*, and *C. Hardingii:* fossils thus named are also noticed in M'Coy's "Synopsis of the Carboniferous Fossils of Ireland," 1844, but without their localities being mentioned.* The only explanation I can give of these identifications is, that specimens of *Schizodus Schlotheimi* occur at Cultra so

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* In Mr. Kelly's paper, previously referred to, these fossils are stated to be from Cultra.

variously distorted as to appear as if belonging to a number of species. I must not dispute, however, the possibility of there occurring in the locality named more species than one—perhaps the *Schizodus obscurus* of Sowerby.

Schizodus Schlotheimi is rather common both at Tullyconnel and Cultra. I am disposed to look on the Schizodus which Mr. Binney has found in the magnesian limestone between St. Bees' Head and Whitehaven as belonging to the present species.* It is abundant in the neighbourhood of Manchester, in Durham, and Germany. Other two or three species of the genus occur in strata of the Permian period.

8. TURBO HELICINUS = *Trochilites helicinus*, *Schlotheim.*—Pl. i., fig. 7; Monograph, pl. xvi., figs. 21–22.

This and the following Gastropods are only suspected as belonging to the genera in which they are respectively placed.

The present species, which rarely exceeds 3-8ths of an inch in height, has tumid whorls, marked with five or more rather prominent spiral ridges, crossed by numerous fine incremental lines. I found only two impressions in the Tullyconnel deposit, one of which supplied me with the gutta percha cast represented, thrice the natural size, under figure 7. It occurs near Manchester; also in Durham and Germany. *Turbo Mancuniensis*, an allied species, with a more elongated spire, appears to be absent at Tullyconnel, although it is a common Permian fossil in the neighbourhood of Manchester and in Durham.

9. TURBO THOMSONIANUS, *King.*—Pl. i.; fig. 8; Monograph, pl. xvi., figs. 23 and 24.

This is a pretty little species, hitherto only known to me as occurring near Sunderland, in Durham. It is smaller than the last, being seldom more than a quarter of an inch in height; and differs from it in being ornamented with numerous fine, thread-like spiral lines. The spire is elevated, resembling, in this respect, the *Turbo Mancuniensis*. Only a single good impression occurred to me, from which I have taken the gutta percha cast represented, thrice the natural size, in figure 8.

10. TURBO TAYLORIANUS, *King.*—Pl. i., fig. 9; Monograph, pl. xvi., figs. 25, 26. This is another small species, ornamented like the last, but differing from it in having a shorter spire. The figure, a little above twice the natural size, is from a gutta percha impression taken from one of the best specimens I found at Tullyconnel, where it does not appear to be rare. It also occurs in the magnesian limestone near Sunderland, in Durham.

11. RISSOA (?) ALTENBURGENSIS = *Turbonilla Altenburgensis*, *Geinitz.*—Pl. i., fig. 10.

12. ——— (?) GIBSONI, *Brown.*—Pl. i., fig. 11.

In addition to the Turbos named, a few impressions of other two species of Gastropods occurred to me in the Tullyconnel limestone, but so small as to render the identifications above given somewhat doubtful. Both are smooth.

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* Vide reference under *Bakevellia antiqua*.

The one identified with *Rissoa Altenburgensis* has the whorls more drawn out than in *R. Gibsoni;* and the latter has apparently more whorls than the former. In some respects they resemble my *Loxonema fasciata* and *L. Geinitziana*, both of which, however, are more elongated. Possibly the shell I have identified with Brown's *Rissoa Gibsoni* is the same as the *Trochus pusillus* of Geinitz. I observed similar shells in Mr. M'Adam's collection of Cultra magnesian limestone fossils. "Some obscure univalves" are noticed in Dr. Griffith's list. *Rissoa Gibsoni* occurs near Manchester, and *R. Altenburgensis* in Germany.

13. CYTHERE ? INORNATA, *M'Coy*.—Pl. i., fig. 13; Monograph, pl. xviii., fig. 9.

Only two distinct specimens of an Entomostracan have been found at Tullyconnel; they are not exactly alike in outline, but sufficiently so to be regarded, for the present, as belonging to one species, which is somewhat between the carboniferous *Cythere inornata* of M'Coy, and the Permian *C. Geinitziana* of Jones. As a Permian fossil, the present species occurs on the coast of Durham.

There are thus thirteen species occurring in the Tullyconnel Magnesian Limestone, all of which are true Permian forms. Furthermore, the deposit is chemically and lithologically the same as much of the Magnesian Limestone in the county of Durham, and in Germany. The same may be said of the Cultra "fossiliferous dolomite." It necessarily follows, then, that the existence of the Permian system in Ireland, is placed beyond all doubt.

The question next arises as to which of the Permian subdivisions the Tullyconnel and Cultra dolomite belongs.

In my Monograph* I published the following Comparative Table of the constituent members of the German and the North of England Permian System:—

MEMBERS OF THE PERMIAN SYSTEM IN GERMANY.	MEMBERS OF THE PERMIAN SYSTEM IN THE NORTH OF ENGLAND.
1. Stinkstein.	1. Crystalline and non-crystalline limestone.†
2. Rauchwacke.	2. Brecciated and pseudo-brecciated limestone.‡
3. Dolomit, or Zechstein Dolomit.	3. Fossiliferous limestone.
4. Zechstein.	4. Compact limestone.
5. Mergel-schiefer.	5. Marl slate.
6. Todte-liegende.	6. Inferior or Lower New Red Sandstone.

* Introduction, p. xvii.

† There occur in Yorkshire and the adjacent counties beds of marl and gypsum which may belong to No. 1, or they may prove a still higher member.

‡ In the second or brecciated member I have only found fossils which appear to have been washed out of the third or "fossiliferous limestone" member.

For present purposes it is unnecessary for me to refer to any but the first and third members. Both are distinguished from each other by palæontological differences. The first member is characterized in the north of England only by a few species of fossils, such as *Mytilus squamosus*, *M. septifer*, *Leda Vinti*, *Pleurophorus costatus*, *Schizodus Schlotheimi*, *Cythere inornata*; whereas the third contains about 143 species (including most of those just named), many of which are bryozoic corals and palliobranchiate shells. The first member is extensively developed on the coast of Durham, the shore cliffs between Hartlepool and South Shields being principally composed of it. In some localities it is highly crystalline, varying extremely in structure; but in most places it is earthy, oolitic, cellular or compact, of a yellowish or brownish colour, and highly charged with carbonate of magnesia. The late Professor A. Johnstone has published the following analysis of the oolitic variety, which is very abundant around Hartlepool:—

Carbonate of lime, ...	54·5.
Carbonate of magnesia, ...	44·93.
Alumina, iron, and phosphoric acid, . .	0·33.
Insoluble matter, ...	0·24.

I have given this analysis of the magnesian limestone of Cultra, because it closely corresponds with one published by Sir Robert Kane.* Mr. M'Adam has kindly furnished me with another of the Tullyconnel limestone made by Dr. Hodges, of Queen's College, Belfast, showing that it too has a very similar chemical composition. Thus, in its lithological and chemical characters, the first member, as it occurs in Durham, offers a remarkably close agreement with the Tullyconnel and Cultra magnesian limestones: further, both possess a palæontological resemblance, which is equally remarkable; for in the Tullyconnel and Cultra beds there is very nearly the same assemblage of fossils as occurs in the upper Permians on the coast of Durham.† This being the case, I cannot refrain from

* Industrial Resources of Ireland, page 246.

† Mr. Bryce states in his "Geological Notice on the Environs of Belfast," &c., that Terebratulæ and Productæ occur in the Cultra magnesian limestone. There is, probably, an error in this statement, as I certainly saw none of these fossils in Mr. M'Adam's collection; nor is Mr. M'Adam himself acquainted with any; nor are there any noticed in Dr. Griffith's list.

drawing the conclusion, that the Irish "fossiliferous dolomite" belongs to the highest member of the Permian system, as developed in the north of England.

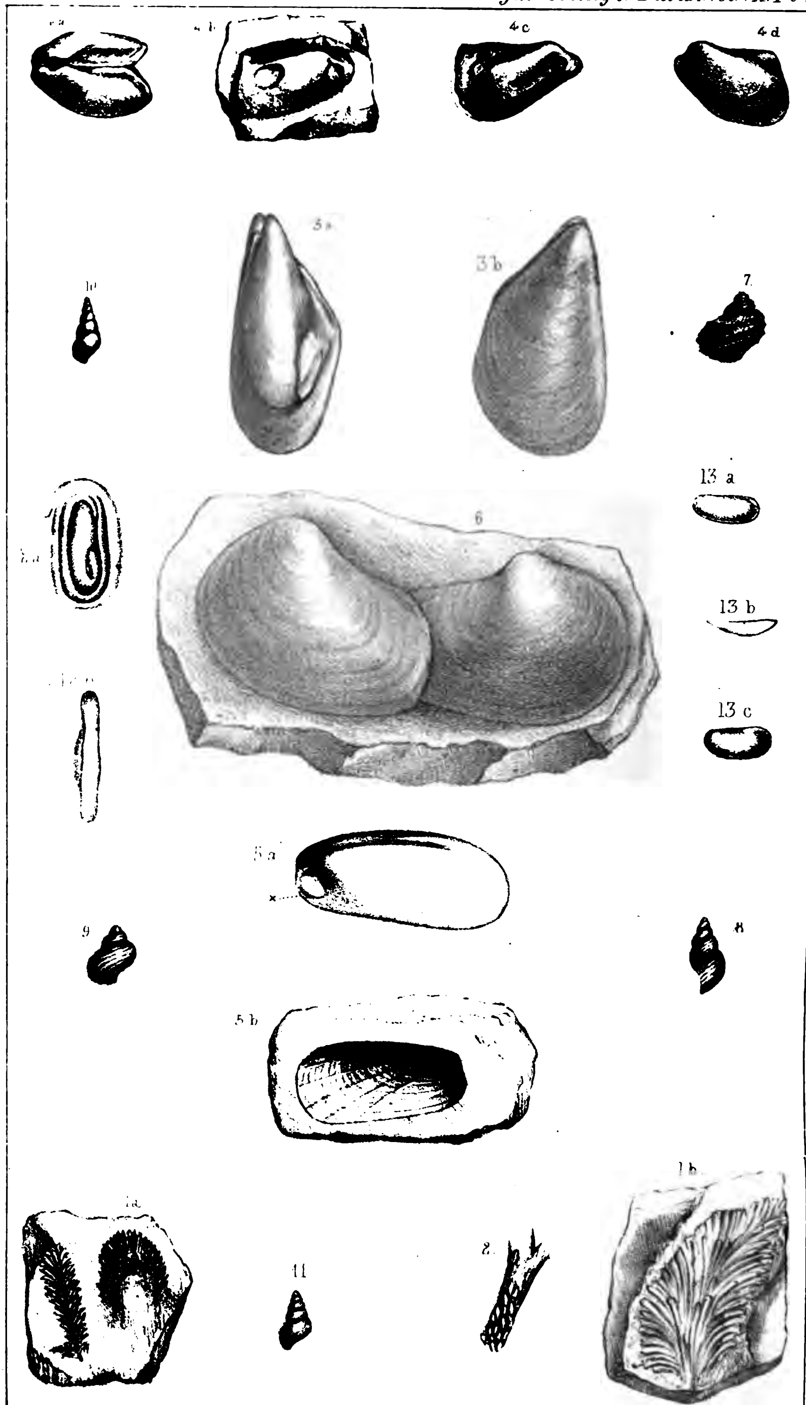
There are some intermediate localities, the geology of which is somewhat confirmatory of the view just advanced. At Collyhurst and some other places near Manchester, there occur some Permian beds, which, although not dolomitic, contain an exactly similar group of fossils as characterizes the upper members in Durham; and I am led to think, that they occupy a high position in the System. At Barrow Mouth, between St. Bees' Head and Whitehaven, in Cumberland, there is a bed of magnesian limestone of a cream colour, 10 ft. 6 in. in thickness, similar to that at Cultra, overlying the coal-measures, and underlying the New Red Sandstone. Fossils are extremely rare in this deposit; but it has yielded Mr. Binney "casts of Bakevellia, Schizodus, and other shells."*

The parallelism which has just been made out between the Irish Permians and the uppermost members of the system in the north of England, I am strongly inclined to believe, may be extended into Germany; for I have elsewhere† pointed out certain evidences tending to prove that the uppermost Permian only (Stinkstein and Rauchwacke) in the Thuringerwald are marked by the presence of a few bivalves, and by the general absence of Bryozoons and Palliobranchs.

In conclusion, the discovery of Permian beds in Ireland is of considerable geological interest; and it may eventuate in vast industrial benefits. In England almost every stratigraphical group or "system" occurring in central and northern Europe has been found; but in Ireland one interesting link in the chain is generally considered as being absent—the Permian System: this link, however, is now supplied. Further, in many parts of Tyrone and the adjoining counties, there are beds whose relative position has long been looked on as doubtful; but the presence of a well-known Permian rock at Tullyconnel is highly calculated to settle their exact geological age. With reference to its industrial importance, there are several districts in the province of Ulster whose surface rock is a freestone, generally supposed to be the "New Red Sandstone,"—a formation so

* Binney "On the Permian Beds of the North-West of England."

† Monograph, "Introduction," pp. xvi. xvii.



W King, Junr. del. W. H. Baily, lith.

Printed by Hullmandel & Walton.

geologically high above the coal-measures as to render, in many cases, the sinking of a colliery shaft through it a ruinous speculation. Should, however, the so-called "New Red Sandstone" turn out to be the Rothe-todte-liegende, or Lower New Red, as I suspect will be the case with that in the south of Tyrone and the adjacent part of Armagh, no expense ought to be spared in boring through it, with the view of reaching workable beds of coal, similar to those of Coal Island, at no great depth below the surface; and there ought to be no delay whatever in ascertaining their existence below the Permian limestone of Tullyconnel.

DESCRIPTION OF PLATE I.

Fig. 1 a. *Favosites Mackrothii.* Natural size.
„ – b. Another specimen, magnified.
„ 2. *Thamniscus dubius.* Twice the natural size.
„ 3 a. *Mytilus squamosus.* Twice the natural size. Cast showing impressions of the pallial line, and the posterior adductor muscle.
„ – b. Another specimen, a cast. Twice the natural size.
„ 4 a. *Bakevellia antiqua.* Natural size. Cast.
„ – b. Another specimen. Cast, enlarged, showing impressions of the teeth, cartilage pits, and adductor muscles.
„ – c. Another specimen. Twice the natural size, showing impressions of the pallial line, adductor and other muscles.
„ – d. Another specimen. Natural size.
„ 5 a. *Pleurophorus costatus.* Cast, somewhat enlarged, showing impressions of the posterior tooth, the anterior adductor muscle, and the ridge behind the latter.
„ – b. Another specimen. Impression of, twice the natural size, showing the ribs emanating from the umbone.
„ 6. *Schizodus Schlotheimi.* Casts, natural size. This is one of the specimens collected by the assistants under Col. Portlock.
„ 7. *Turbo helicinus.* Thrice the natural size.
„ 8. —— *Thomsonianus.* Thrice the natural size.
„ 9. —— *Taylorianus.* A little above twice the natural size.
„ 10. *Rissoa* (?) *Altenburgensis.* } Thrice the natural size.
„ 11. —— (?) *Gibsoni.* }
„ 12 a. *Spirillina pusilla.* } × about 12 diameters.
„ — b. ——— ——— }
„ 13 a. *Cythere* (?) *inornata.* } × about 8 diameters. The specimen under figure *a* has a corner broken off.
„ — b. ——— ——— }
„ — c. ——— ——— }

All the specimens represented in the plate, with the exception of the Spirillina and Cythere, are placed in the palæontological collection of the Museum of Irish Industry, mounted and named.

ANNUAL ADDRESS

DELIVERED BEFORE THE

GEOLOGICAL SOCIETY OF DUBLIN,

FEBRUARY 13, 1856,

BY

LORD TALBOT DE MALAHIDE,

PRESIDENT OF THE SOCIETY.

Gentlemen,—I feel considerable diffidence in addressing you on this, the twenty-fifth anniversary of the formation of the Society, fully aware of my own deficiencies, and of the high character and scientific distinction which my predecessors have justly earned for themselves by their labours in the field of Geology, and the valuable contributions they have added to the stores of geological literature. Moreover, from a pressure of circumstances during the past year, I had been particularly trammelled with engagements such as precluded me from following up very closely this interesting science. I have long been much interested in its progress; and although I have not had many opportunities of investigating the different sections of the country, it would argue a very uninquiring or apathetic mind, when once initiated into its mysteries, however superficially, not to have taken some pains to ascertain the new phases which Geology is assuming, the theories which have stood the test of time and discussion, as well as the great advance which the united labours of the mineralogist, the palæontologist, the chemist, and the mathematician, have contributed to produce of late years. I feel most proud of having been called on at such a time to preside over you; and, although our numbers are comparatively few and our papers not very frequent, I have the highest authority for stating that the London Geological Society—which may be called the parent of all such societies—is already proud of the zeal and achievements of some of our members.

The Report of the Council having entered into statistical details, I shall not dwell much on the proceedings of the past year. I may, however, be permitted to congratulate you on the very important and interesting paper read by my learned predecessor and Mr. Salter on the line of demarcation between the Carboniferous and Devonian rocks in the south of Ireland. This is a most important and interesting subject; and without expressing any opinion upon this controversy, I am sure you will join with me in the wish that we may have such further detailed information as may set this point at rest. Our worthy Vice-President, Dr. Griffith, has entered into the field, and I trust that he will continue to favour us with his extended researches. There are at the present moment several similar controversies afloat, such as the distinction between the Cambrian and Lower Silurian rocks, between the Eocene and Cretaceous formations; and, indeed, as might naturally be expected, the gradual progress of the science, and the minute investigation which is being extended to all the strata of the earth, show the extreme difficulty of drawing abrupt lines of distinction on palæontological grounds. Mr. Du Noyer has given us a very interesting communication on the neighbourhood of Killarney; and Professor King, of Queen's College, Galway, has given us a most important paper on the deposits of Artrea in the county of Tyrone, which he demonstrates to belong to the Permian period, instead of the New Red Sandstone. This discovery may lead to the most important results with reference to the working of our coal mines. We have also had some most valuable papers on the composition of the Irish granites. Every one who has heard the Rev. Samuel Haughton's contributions must be aware of the great accuracy of his investigations; and I understand that he has obtained most original mineralogical data for classifying by eye the different granitic rocks. The Rev. Professor Galbraith has also been a most assiduous labourer in this field. And here I hope that I am not travelling beyond my province in alluding briefly to the controversy in which this gentleman has engaged with reference to the existence of porcelain clay in Ireland. No one can be better qualified than he is to express an opinion of the quality of the Irish clay, or of its fitness for the production of those beautiful wares, which have added so much lustre to the manufacturing reputation of Staffordshire, and so much wealth to its inhabitants. We must also look to him, and such philosophers, to dispel erroneous views which may lead to popular delusions and rash speculations. However, I am myself deeply impressed with the importance of advancing by every means in our power the industrial wealth of Ireland; and we must consider that if our country does not contain within itself all the ingredients for the manufacture of porcelain, it is well known that neither in Staffordshire nor Worcestershire are to be found any of the raw materials used in its manufacture, unless coal is to be included in this term. With the great extent of granitic and quartz rock in Ireland, there is nothing improbable in the discovery of kaolin and silex fitted for manufacture, and if the kaolin is in an impure state, it is well worth the pains of experimental philosophers to ascertain whether there is not some easy process of purifying it from the iron and other deleterious ingredients which it may contain. Far, however, be it from me to urge the establishment of manufactures of this kind on the loose data that have been brought forward, as I am convinced that without due energy and perseverance no enterprise can succeed, and that with these valuable assistants there is no country which is not able to place itself in an advantageous position in the markets of the world.

Another interesting subject is the Drift of Ireland. As Professor Jukes has well observed, it has not been treated with the attention it deserved. Mr. Thomas Stanly has, however, read a paper on the subject; and I trust that Mr. Kelly has not abandoned a subject into which he has inquired with his usual accuracy and discrimination. We also owe to Mr. Kelly a very voluminous catalogue of fossils of the Irish Carboniferous Limestone. One of the characteristic features of geological literature is the disposition to divide the labour of observation into monographs, and no system is more likely to enable us to place Geology nearly on the footing of an exact science.

It may appear great presumption on my part to attempt anything like a review of the general state of Geology at the present moment, and therefore I shall not attempt any such thing;—but I cannot deny myself the gratification of congratulating you on the great addition we have received during the past year to the information we previously possessed of the physical structure of the globe.

Even a cursory reader could not fail being struck, even a very few years since, with the very great blanks which prevailed in the geology of countries that ought to have been by this time tolerably well known. One great blank has been, in a great measure, removed by the wonderful map of India by Mr. Greenough—the Nestor of Geology; he will transmit his name to future ages by two maps, which contained at the time of their publication an enormous amount of information for any single private individual to have compared and digested. The Geological Survey, under the auspices of the East India Company, will of course supply exact information on those points, not only of the greatest value in a scientific point of view, but of great use to every industrial undertaking, whether it be mining or agricultural; whether it be to make roads, or to convey water from a damp to a thirsty soil. The rapid extension of those geological surveys is probably the most characteristic feature of the day. Not only France and Germany have nearly completed this work, but our Transatlantic brethren have made great efforts, and are still doing so, to promote the many capabilities of their enormous territory. Isbister's Essay on the Geology of North America, published in the English Geological Journal, contains a vast amount of information on those inhospitable latitudes, which have been traversed by so many expeditions, and in which, alas, many a hero has fallen a martyr to his duty and his love of science! It is very gratifying to find Mr. Sharpe investigating, with his usual accuracy, the interesting provinces of Portugal; and some precise information about Spain is very much required. It is true that Capt. Widdrington several years ago, in his interesting Tour, described many of its more peculiar features. Mr. Pratt and the gentlemen connected with the Asturian mines have also given us some occasional glimpses into the interior of the crust of that rich land. Dr. Daubeny also gave an interesting description of his search after the Apatite mines of Estremadura. There has also been a great accession to our knowledge of the geology of South Africa. Captains Gordon and Sutherland have identified and described the cretaceous strata of Port Natal. However, probably the most original and curious fragment of extra-European geology is Mr. Loftus's account of the mountain ranges extending on each side of the boundary between Turkey and Persia. He has made a noble use of his opportunities when connected with the Mixed Boundary Commission; and it is very much to be wished that a detailed and well-illustrated report should be published under the Government supervision as to that district. The great impetus which the gold discoveries have given to the physical exploration of Australia still continues to produce the most valuable results. Mr. Clarke, Selwyn, and others, are constantly adding to our knowledge of the formations of that continent, and it will surprise every inquirer who a few years since would have been dependent on the superficial inquiries of Mitchell, Streletzki, and the hurried notes of our late worthy President, to find the number of well qualified labourers in this field. The French Government has generally been successful in combining the objects of war and science, and few of their expeditions into wild countries during the last thirty years have been unaccompanied with a scientific and artistic staff. To them we owe the valuable reports on Egypt, the Morea, Algeria; and I have no doubt that, at the conclusion of this war with Russia, there will appear, at the expense of the French Government, some important contributions to the natural history of Turkey and the Crimea, if not of the Baltic. If the additions to the range of our inquiries are satisfactory, it is equally satisfactory to find that we are rapidly obtaining a much more accurate knowledge of those productions, with which we flattered ourselves we were tolerably well acquainted. How invaluable the researches going on under the care of the gentlemen of the Ordnance Geological Survey in the Silurian and Cambrian rocks! It is to be hoped that they will be rewarded with the discovery in Great Britain of the unique protozoic fossil, the Oldhamia. In an equally interesting field, Mr. Prestwich has made discoveries startling and original. The London clay may be said to have been the first and most minutely explored of English fossiliferous beds, and yet it remained for Mr. Prestwich to place them in their proper position, and to find equivalents for one of the Parisian beds which had escaped the most accurate observers.

The great English geologists do not appear by any means to be resting on their oars, or to trust to their past acquired name for maintaining their proper position in the geological world. Sir Roderick Murchison, ever bent on extending and correcting his former observations, has published a most interesting Report on the Geology of the North of Germany. We cannot be too grateful to him for his giving us the true place of the Nummulite beds. Mr. Hamilton, the learned President of the Geological Society, is indefatigable in working out the Rhenish formations. The Rev. Professor Sedgwick has not relinquished his hold of the lower Silurian deposits; and Sir Charles Lyell, who supports his beautiful theory with such an array of information, and such a clearness of expression, that one cannot avoid yielding one's assent to them, has produced a detailed account of the island of Madeira. It may not, perhaps, be out of place here to make a few observations on those important practical subjects on which our members can throw the light of their talent and their industry. Every scientific inquiry is, doubtless, practically useful; and although many sciences may not appear likely ever to lead to positive results, experience has proved otherwise. The great value of Conchology is a striking proof of this assertion. I need not allude to the importance of the fullest information being supplied to us relative to mines, to coal, or to salt. The different mineral raw materials scattered through the country—our beautiful marbles, which are at present so inefficiently worked—the different questions relating to the connexion between Agriculture and Geology—all should engage our close attention. I may also invite your particular attention to the question of the bogs. Monographs of these made by competent persons would, in my opinion, be of the greatest practical importance, and there are many theoretical questions connected with them which have not obtained the attention which they deserve. From a very partial observation, I cannot resist the conclusion that a great portion of the surface now covered with peat is of recent formation, and it would be most important, in the absence of topographical and historical information, to obtain geological data, so as to settle this subject. No gentleman could be more competent to deal with it than Professor Allman, who combines such an amount of zoological and botanical knowledge with Geology. He has been obliged to resign his place on the Council from the pressure of his new duties, and we must feel proud of one of our alumni being placed in the high position of successor to Professor Forbes. With my friend Professor Jukes, I have had the painful task to mourn over his loss. He conferred great benefits on the Irish Geological Survey, and it will be long before we see his equal in Palæontology.

This year has also been signalized by the loss of Sir H. de la Beche, the head of the Geological Survey. He was a member of this Society, and anxious for its success. It is hard to speak in sufficiently high terms of the obligations which we owe him. He may not have possessed the genius, the acquirements, the eloquence of a Sedgwick, a Buckland, a Murchison, or a Lyell; he may not have had the same gift of clothing the most abstruse questions in clear and intelligible language: but to none does our science owe more. He was one of the earliest cultivators of it, one of the most industrious observers, a good mineralogist, and the founder of the Ordnance Geological Survey and the Museum of Practical Geology and the School of Mines. He was also a most constant contributor to the Transactions of the Geological Society. His "Geological Manual," and "How to Observe in Geology," have long been considered as standard works; and one of his earliest and least known productions, "Researches in Theoretical Geology," is remarkable for some very interesting views of the probable mode of formation of our planet. His loss will be long and deeply felt; but a more efficient and fit successor could not be found than Sir Roderick Murchison, and under his auspices I have no doubt that in a few years' time all our geological questions will have been so far elaborated, that it will indeed be a difficult task to make any important discoveries in it, except by resorting to the aid of that great discoverer of unknown worlds—the microscope—by means of which Ehrenberg has extended to such an extraordinary degree the domain of nature, and enlarged our views of the power and intelligence of the Supreme Being and Creator of the universe.

AT THE

ANNUAL GENERAL MEETING

HELD ON

WEDNESDAY, FEBRUARY 13th, 1856,

GILBERT SANDERS, ESQ.,

IN THE CHAIR,

The following Report from the Council was read and adopted:

Your Council offers the usual list of the Members actually belonging to the Society, from which it appears that the effective strength of the Society consists at present of 165 Members.

Honorary Members,	5
Corresponding Members,	4
Life Members,	43
Annual Members,	82
Associates,	31
Total,	165

In the first Appendix to this Report, a statement of the total Members gained and lost during the year is given, from which it appears, that we have gained nine new Members to our list during that period.

The following view of the progress of the Society, for the past ten years, is submitted to your attention, as it appears to your Council to afford an encouraging prospect of our future success; as the Journal of the Society proves that the additional Members gained by us from year to year have been not merely additions to our numbers, but also useful additions to our stock of working geologists:—

Number of Members for Ten preceding years.

In 1846	84	Members	In 1852	132	Members.
„ 1847	91	„	„ 1853	142	„
„ 1848	97	„	„ 1854	146	„
„ 1849	100	„	„ 1855	156	„
„ 1850	110	„	„ 1856	165	„
„ 1851	123	„			

During the past year the papers read before the Society have been unusually interesting, and some of them likely, from their practical bearing, to possess an interest for many who are not as yet Members of our Society. It is hoped by your Council that the increased circulation likely to be obtained by our publications, in consequence of the recent arrangement with the Editors of the Natural History Review, will attract the notice of some who may wish to join the Society; and that our labours, becoming better known, will be better appreciated than they have yet been by many whose interests are intimately connected with the progress of Geological Science.

The first number of the Natural History Review, which contains the Journal of the Geological Society of Dublin, has been already delivered to each Member of the Society not in arrear of subscriptions; and it is hoped that a similar number of this Review, containing papers read before your Society, will be placed each quarter in the hands of all our Members, who will thus receive the publications of the Society four times per annum, instead of, as hitherto, only once; and that too at an uncertain interval.

Let each Member of the Society make his friends acquainted with the advantages to be obtained by joining us; and let us endeavour to increase the number of our Subscribers to an extent which will place us in a position, which, in a financial point of view, will be suitable to the important objects the Geological Society of Dublin has kept steadily in view for the quarter of a century during which it has lived and thriven.

Your Council also desire in this Report to acknowledge the liberality of the Board of Trinity College, by which they have been enabled to make some valuable additions to the list of their publications.

In the Appendix following the Report will be found the statement of our accounts for the past year, from which it appears that there was a balance of £28 13*s.* 5*d.* to the credit of the Society on January 1, 1856.

APPENDIX TO ANNUAL REPORT.

No. I.

MEMBERS ADDED.

Honorary Corresponding Members.

John S. Kennedy, Esq.
Henry B. Medlicott, Esq.

Life Members.

Sampson Carter, Esq., C. E.

Annual Members.

Griffin Byrne, Esq.
Edward S. Clarke, M.D.
Lord De Vesci.
J. W. Kavanagh, Esq.
Thomas W. Kingsmill, Esq.
John Lloyd, Esq., C. E.
Dominick M'Causland, Esq.
Hamilton Willis, Esq.

Associates.

Robert Barton, Esq.
W. B. Brownrigg, Esq.
Henry D. Crozier, Esq.
John W. Fisher, Esq.
Jacob Henry Geoghegan, Esq.
Robert Gwynne, Esq.
W. E. Hamilton, Esq.
Francis Hewson, Esq.
John Hime, Esq.
Alexander Johnson, Esq.
D. A. M'Cready, Esq.
John Nolan, Esq.
John Richardson, Esq.
Richard W. Stewart, Esq.
Arthur G. Waller, Esq.

LOST FROM DEATH AND OTHER CAUSES.

Life Members.

Sir Henry T. De La Beche.

Annual Members.

Hans W. Allen, Esq.
Professor Allman, M. D.
Halliday Bruce, Esq.
William W. Campbell, Esq.
Emerson Dawson, Esq.
Henry English, Esq., C. E.
James H. Hamilton, Esq., M.P.
John S. Kennedy, Esq.
John Lloyd, Esq., C. E.
Henry B. Medlicott, Esq.
Luke White, Esq.
Richard Wolseley, Esq.

Associates.

Arthur Jacob, Jun., Esq.
Joshua H. Lamprey, Esq.
Thomas M'Comas, Esq.
William Smith, Esq.

Total added, ...	26
Total lost, ...	17
Gained, ...	9

PRESENT STATE OF SOCIETY.

Honorary Members,	5
Corresponding Members,	4
Life Members,	43
Annual Members,	82
Associates,	31
	165

In February, 1855,	156 Members.
In February, 1856,	165 „
Gained,	9 Members.

No. II.

DONATIONS SINCE FEBRUARY, 1855.

1855.

Feb. 16.—Proceedings of the Royal Irish Academy, Vol. VI., Part 1. Presented by the Academy.

Mar. 3.—Rejoinder to Professor Milne-Edwards and Mr. Bowerbank. On the May Hill Sandstone, and the Palæozoic System of England. By the Rev. Professor Adam Sedgwick, F. R. S., F. G. S. Presented by the Author.

Mar. 14.—A Fossil "Bone." Presented by Edward Fitzgerald, Esq., Youghal.

Mar. 28.—Proceedings of the Linnean Society, Nos. 42 to 58; with a List of the Society, 1854. Presented by the Society.

April 4.—The Mining Journal, Nos. 1019, 1022, and 1023. Presented by the Editor.

April 30.—Selections from the Records of the Bengal Government, Nos. 6, 8, and 13 (1852–3). A Geological Report on the Kymore Mountains, the Ramghur Coal Fields, and on the Manufacture of Iron, &c. By D. H. Williams, Esq. A Geological Report on the Damoodah Valley. By D. H. Williams, Esq. Presented by Thomas Oldham, Esq., F. R. S.

April 30.—Proceedings of the Zoological Society of London, Nos. 201 to 257. Presented by the Society.

June 6.—The Natural History Review, Nos. 5 and 6. Presented by the Dublin University Zoological Association.

June 13.—The Mining Journal, No. 1029. Presented by the Editor.

June 13.—Proceedings of the Linnean Society, Nos. 59 and 60. Presented by the Society.

June 20.—Abstracts from the Meteorological Observations taken at the Stations of the Royal Engineers in the year 1853–4. Presented by Lieut.-Col. James, R. E.

June 29.—Transactions of the Kilkenny Archæological Society, for the year 1853. Presented by the Society.

July 10.—On an Analysis of the Potash and Soda Felspars of one of the Dublin Mountains. By Francis M. Jennings, M. R. I. A., F. G. S. Presented by the Author.

Sept. 24.—Proceedings of the Liverpool Literary and Philosophical Society, No. 9. Presented by the Society.

Oct. 3.—On the Permian Beds of the North-west of England. By Edward W. Binney, F. G. S. Presented by the Author.

Oct. 15.—The American Journal of Science and Arts. Second Series, No. 59, Sept., 1855. Presented by the Editors.

Oct. 20.—A Memoir on the Extinct Sloth Tribe of North America. By Joseph Leidy, M. D. Publications of Learned Societies and Periodicals in the Library of the Smithsonian Institution, Part I. Eighth and Ninth Annual Reports of the Board of Regents of the Smithsonian Institution, 1853–4. Presented by the Smithsonian Institution.

Oct. 20.—Report on the Agriculture and Geology of Mississippi; embracing a Sketch of the Social and Natural History of the State. By B. L. C. Wailes. Presented by the Author.

Oct. 20.—Proceedings of the Boston Society of Natural History, Vol. IV., Nos. 25, 26; Vol. V., Nos. 1 to 11. Presented by the Society.

Oct. 20.—Proceedings of the New Orleans Academy of Sciences, Vol. I., No. 1; with the Constitution and By-Laws of the Academy. Presented by the Academy.

Oct. 25.—Introductory Lecture on Geology; delivered by H. B. Medlicott, A. B. and C. E., T. C. D., Professor of Geology, to the Students of the Thomason Civil Engineering College, Roorkee, on the 15th May, 1855. Presented by the Author.

Oct. 27.—Abstracts of the Proceedings of the Ashmolean Society, Vols. I., II. and Nos. 31 and 32. Presented by the Society.

Oct. 31.—Address to the Royal Geographical Society of London; delivered at the Anniversary Meeting on the 28th May, 1855. By the Right Hon. the Earl of Ellesmere, K. G., D. C. L., &c., President. Presented by the Society.

Nov. 5.—Transactions of the Royal Scottish Society of Arts, Vol. IV., Part 3. Presented by the Society.

Nov. 10.—Tours in Ulster: a Hand-book to the Antiquities and Scenery of the North of Ireland. By J. B. Doyle. Presented by the Author.

Nov. 14.—The Natural History Review, Vol. II. Presented by the Editors.

Nov. 14.—A Geological Map of India. By W. Greenough. Presented by the Executors.

Nov. 14.—A Geological Map of Wisconsin. By I. A. Lapham. Presented by the Compiler.

Nov. 26.—On the Cleavage of the Devonians of the South-west of Ireland. By Robert Harkness, F. R. S. E., F. G. S., and John Blyth, M. D. Presented by the Authors.

Nov. 26.—On the Geology of the Dingle Promontory. By Robert Harkness, F. R. S. E., F. G. S. Presented by the Author.

Dec. 19.—Description Géologique du Département de la Seine-Inférieure. With Atlas. Par M. Antoine Passy. 4to. Rouen, 1832. 2 vols. Presented by the President.

Dec. 19.—The American Journal of Science and Arts, No. 60. Presented by the Editors.

Dec. 21.—Historic Society of Lancashire and Cheshire.—Proceedings and Papers, Vols. I. to VI., and "Transactions," Vol. VII. Presented by the Society.

1856.

Jan. 2.—Quarterly Journal of the Geological Society of London, Nos. 41 to 43. Presented by the Society.

Jan. 2.—Journal of the Royal Geographical Society of London, Vol. XXIV. With a Paper on the Origin, Objects, and Progress of the Society. Presented by the Society.

Feb. 13.—Proceedings and Transactions of the Kilkenny and South-east of Ireland Archæological Society, for the year 1855, Vol. III., Part 2. Presented by the Society.

Feb. 13.—The Athenæum, 1855. Presented by the Editor.

Feb. 13.—The Literary Gazette, 1855. Presented by the Editor.

Feb. 13.—Journal of the Society of Arts, Nos. 117 to 168. Presented by the Society.

Feb. 13.—The Irish Reporter, Nos. 1 and 2. Presented by the Editor.

No. III.

ABSTRACT OF THE TREASURER'S ACCOUNT FOR THE YEAR 1855.

Dr.

1855.	£ s. d.	£ s. d.
To Balance from last year,		22 0 11
— Three Half-years' Dividends in the Funds,		5 8 11
— Sale of Journals,		3 0 0
— Admission Fees,		9 0 0
— Annual Subscriptions,	60 10 0	
— Do. do. from the Accounts of late Treasurer,	3 0 0	63 10 0
		£102 19 10

Cr.

1855.	£ s. d.	£ s. d.
By One Half-year's Salary to Assistant Secretary,	10 0 0	
— Gratuity to Attendant,	1 10 0	
(per Draft 5137)		11 10 0
— Cash returned to Professor Harkness, overpaid on Life Subscription (Draft 5139),		5 0 0
— Mr. Gill's Account for Printing,	3 11 0	
— Mr. Oldham's do. for Engraving,	11 19 6	
(per Draft 5140),		15 10 6
— Incidentals per Assistant Secretary (Draft 5141),		11 15 7
— One Half-year's Salary to Assistant Secretary, (per Draft 5142),		10 0 0
— Mr. Oldham's Account for Engraving,	3 15 0	
— Mr. Tallon, for Stationery,	1 4 0	
— Incidentals, per Assistant Secretary,	6 10 4	
(per Draft 5143),		11 9 4
— Incidentals, per Assistant Secretary,	5 11 9	
— Collector's Commission,	3 9 3	
(per Draft 5144),		9 1 0
		74 6 5
Balance,		28 13 5
		£102 19 10

The Report having been read and adopted, the Ballot was closed, and the following Officers and Council declared duly and unanimously elected.

President:

LORD TALBOT DE MALAHIDE.

Vice-Presidents:

JAMES APJOHN, M. D.
PROFESSOR HARVEY, M. D.
JOSEPH BEETE JUKES, M. A.
REV. HUMPHREY LLOYD, D. D.
RICHARD GRIFFITH, LL. D.

Treasurers:

SAMUEL DOWNING, C. E.
GILBERT SANDERS, ESQ.

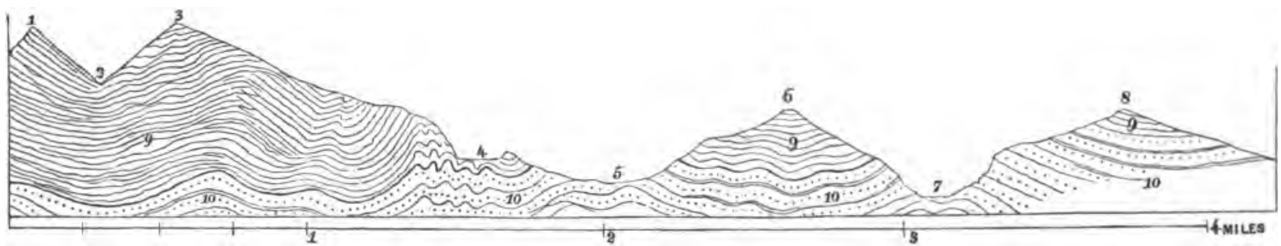
Secretaries:

REV. PROFESSOR HAUGHTON, F. T. C. D.
FREDERICK J. SIDNEY, LL. D.

Council:

ROBERT BALL, LL. D.
JOHN MACDONNELL, M. D.
ROBERT CALLWELL, ESQ.
ROBERT MALLET, C. E.
REV. J. A. GALBRAITH, F. T. C. D.
JOHN KELLY, ESQ.
GEORGE M'DOWELL, F. T. C. D.
EDWARD WRIGHT, LL. D.
RICHARD PURDY ALLEN, ESQ.
REV. GEORGE LONGFIELD, F. T. C. D.
SAMUEL GORDON, M. D.
JOHN B. DOYLE, ESQ.
THOMAS HUTTON, ESQ.
DOMINICK M'CAUSLAND, M. A.
WALTER S. WILLSON, ESQ.

Section from Carrantwohill on the N. W., to Knocknabreda on the S. E., Co. Kerry.—To illustrate Mr. G. V. Du Noyer's Paper "On the Geology of the Lake District of Killarney."



Scale for height and distance the same.

No. 1. Benkeeragh Mount, 3314 feet.
2. Lough Cummeenoughter, 2338 feet.
3. Carrantwohill Mount, 3414 feet.
4. Carraghmore Lake, 1004 feet.
5. Carraghmore Glen.
6. East flank of Sugarloaf Mount.

No. 7. Black Valley at Lough Reagh.
8. Knocknabreda Mount, 1811 feet.
9. Middle Subdivision of the Old Red Sandstone. Purple Grits and Slates, with a few Conglomeritic Layers in the upper portion. Jasper Pebbles not uncommon.

No. 10. Lower Subdivision of the Old Red Sandstone. Greenish-gray and Green Chloritic Grits and Slates, with bands of Purple Slate. The Grits often finely conglomeritic, containing Pebbles of Jasper.

THE Society met on the 9th of January, 1856, on which occasion the following Paper was read.

ON THE GEOLOGY OF THE LAKE DISTRICT OF KILLARNEY.

BY MR. GEO. V. DU NOYER.

THE district to be described comprises in superficial extent an area of about 100 square miles, inclusive of the Lakes; and is marked on the Ordnance Survey Index of the county of Kerry as sheets 65; southern half, 66, 73, 74; and the northern halves of 83, 84. It will be seen, therefore, that Carrantwohill Mount, Macgillicuddy's Reeks, and the Black Valley, the Range of Knocknabreda, with Cromagloun and Torc Mountains, the rocky ridge terminating in the Eagle's Nest, Cliff, Mangerton, and the Devil's Punch-bowl, are included in this area.

As he proposed noticing the rocks in descending order, he had first to speak of

THE COAL-MEASURES.

These occupy but a small portion of the district, and constitute its northern boundary, forming the low ridge of ground on which the old church of Aghadoe stands. They consist of thick beds of dark gray, splintery shale, often almost black, and sometimes presenting a concretionary structure. Through these shales are thick and thin bands, and often sets of beds of hard gray and olive gray grits, in the thinner layers of which, impressions of coal plants are not uncommon. The only point of present geological interest connected with these coal-measures is the fact, that wherever they can be well observed along their southern boundary, they invariably dip to the south from 30° to 65°,—thus appearing to underlie the Carboniferous Limestones. As this discrepancy in the dip is persistent for many miles from the west of Killarney to Mallow, a distance of fully 50 miles, it can only be accounted for by supposing either a fault, or an inversion of the beds by contortion.

CARBONIFEROUS LIMESTONES.

In Muckross Demesne occurs the most perfect development of the Carboniferous Limestones of the Killarney district. The uppermost beds there, or those which occur in the eastern portion of the Demesne, are all of a light gray colour, close-grained and finely laminated,—a structure apparently in many instances due to cleavage;

but where the bedding is at all discernible, it dips southward from 35° to 40°; where the cleavage prevails, its inclination and strike coincide with those of the beds. Fossils are sparingly scattered through these limestones, and consist chiefly of crinoid fragments. As we proceed westward, dark gray chert sometimes occurs in irregular and thin lumpy layers, but generally the rock is homogeneous in character. Below the beds just described are others which are finely crystalline, with numerous hard, irregular, semi-calcareous layers, weathering out like chert. These siliceous beds are well seen on the western shore of Dundag Bay, close to Muckross Abbey, the seat of Colonel Arthur Herbert; they also dip southward at 60° to 70°, and may probably be about 200 feet in thickness. The same beds cross the entrance to Kilbeg Bay; and close to the Devil's Island they are contorted in such a manner as to indicate the presence of a fault, which he named the Doo Lough fault.

Immediately below these siliceous beds, light gray laminated limestones again occur, similar in character to those first described, and traceable along the shore of Mine Paddock Bay still farther to the west, dipping south at 40°, and presenting a thickness of about 300 feet.

At the northern extremity of Mine Paddock Bay a remarkable set of beds are now observed. These are best seen at the "Marble Quarries" west of the bay, and consist, first, of thin lenticular layers of white, pink, and greenish compact marble, with numerous irregular laminæ of green and purple argillaceous shale, not calcareous. Second, light-gray compact marble, in very thin layers, with light green argillaceous shale partings, the average dip of all being southwards at 30°, with a thickness of about 50 feet. These beds are totally devoid of fossils. Below these marble layers the limestone becomes gray and finely crystalline, with chert layers arranged closely together. As we descend in the series, the chert dies out; and along the shore east of the old copper mine the limestone becomes decidedly crystalline and fossiliferous, rather regularly bedded, and the chert occurs sparingly in nodules. About 500 feet west of the beds last described, the old copper mine occurs; it appears as occupying a break in the limestones, striking E. N. E. from the shore, where it is filled with decomposed iron pyrites. Fragments of copper pyrites lie scattered about, and many of these, when broken, exhibit strings of galena. West of the lode the limestones become thin-bedded, dark gray, finely crystalline, and occasionally compact with crinoid fragments and other fossils; and these beds rapidly graduate down into the Carboniferous Slate, as we proceed still further to the west.

If therefore we take the thickness of the limestone, from the top of the first siliceous beds observed at Dundag Bay to the top of the Carboniferous Slates, we have a total amount of 800 feet; this does not include the upper beds to the east in Muckross Demesne, the thickness of which is nowhere ascertainable. At the entrance to Coolough Bay, west of the copper mine, the Carboniferous Slates are well seen. They average about 250 feet in thickness, and dip southwards at 40°. In general character they consist of dark gray slate beds, with a few thin crystalline limestones, thin gray grits, and gritty slate layers, all more or less fossiliferous. The most common fossils are:—*Orthis filiaria*, *Strophomena crenistria*, *Spirifer disjunctus*, *Athyris planosulcata*, *Fenestella plebeia*, and stems of Actinocrinus. At the base of the section, and resting on the upper Old Red, there is a set of thin gray grit layers and gritty slates, almost devoid of fossils, and probably occupying the position of certain well-marked beds in the Bantry Bay section, termed by Mr. Jukes, Comhola grits.

From Coolough Bay the Carboniferous Slates strike westerly, with the same dip as last observed, till they cross over from Muckross Peninsula (south of Brickeen Bridge), on to Brickeen Island, where they, as well as the upper Old Red beds, are cut off abruptly by a N. and S. fault, which he named the Brickeen Island fault; and here the Carboniferous Slates and Limestones of Muckross terminate to the west.

Returning now to the marble quarries, and taking those peculiar beds as a well-marked geological horizon, they can be traced eastwards for the distance of 1200 feet, when they abut against the Doo Lough fault, and are shifted northwards about 250 feet by the fault which is a downcast to the N. E.; where the line of this fault crosses the gray compact limestone, underlying the marble layers, the former is changed to a light brown dolomite. He remarked that the Doo Lough fault had a probable strike of N. 55° W., traversing obliquely across Muckross Peninsula from the small promontory on the south close to the Devil's Island, right through the centre of Doo Lough, and from thence into the small rocky inlet west of Ardnagluggen Point, on the north shore of Muckross.

On the north shore of Muckross, the limestones, though well exposed, do not present such clear sections as on the south; and at one inlet, to the east of the Carboniferous Slates of West Meadow Bay, a dyke-like mass of light brown crystalline dolomite, 6 to 8 feet thick, filled up an apparent fault in the limestone below the Carboniferous Slates of West Meadow Bay, which dip S. and S. E. at from 25° to 40°. The upper Old Red beds appear on the south shore of the bay.

UPPER OLD RED SANDSTONE.*

The upper Old Red observed in Muckross Demesne occurs in a band of about 400 feet in thickness; it is well seen in the south shore of West Meadow Bay, where its general strike is W. S. W. It abuts against the east side of the Doo Lough fault, which, being an upcast to the S. W., shifts it for a considerable distance to the southward; these beds are then traceable on the south shore of Doo Lough, from whence they continue westerly till they strike on Brickeen Island, where they are cut off by the fault previously noticed. They may be briefly described, in descending order, as consisting of:—1. Thick and thin quartzose grits. 2. Purple slates. 3. Greenish and gray shales, and slates with sandy slate beds, containing root-like impressions of plants. 4. Yellow grits and shales, with thin calcareous layers. 5. Gray grit. And lastly, purple slates.

Directly below the upper Old Red, just described, are a series of purple slates and grits, which preserve the same character for the thickness of 400 feet, when a mass of hard, irregularly bedded, light greenish-gray grits occur, quite free from purple slates. These form the cliffs from Ardnagluggen Point to the Gun Rock; calcareous bands occasionally appear through these beds.

The eastern half of Brickeen Island, with the adjoining rocky islets to the north, is formed of purple slates and grits; but these are cut off by the Brickeen Island fault, and abut against the lower greenish-gray grits which form the western extremity of the island.

To complete the description of the Carboniferous Limestones of

* In order to avoid any controverted points in the classification, it is thought best to use the term "Old Red Sandstone," instead of Devonian, throughout this paper. The beds, which are here called "Upper Old Red Sandstone," are believed to be those, more or less completely, which Dr. Griffith marks by a yellow band in part of this district, and denominates "Yellow Sandstone."

the district, he remarked that the Lower Lake of Killarney is formed almost entirely in the limestone; Ash Island, Cow Island, and Yew Island, are portions of it; but on Rough Island appeared the marble and schistose layers first observed at the marble quarries of Muckross Peninsula,—a fact of much importance as determining the probable position of the Carboniferous Slates and other lower rocks at the bottom of the Lake. The rocky masses known as Elephant Rock, Table Rock, Crow Island, Otter Island, Jackdaw Rock, and Swallow Island, are formed out of the light gray laminated limestones, being portions of those beds which overlie the marble layers. The next place to the east where the marble layers occur is in the farm-yard attached to Cahernane House. From the peculiar position of these beds, they are probably brought to view by a N. and S. fault, occurring somewhere near the mouth of the Flesk River. Local protrusions of lower beds are rendered probable in this district by facts first observed by Mr. Du Noyer in the early part of 1855,—namely, a protrusion of upper Old Red in the midst of the Carboniferous Limestones, a few miles west of Mallow, at Dromaneen Castle on the Blackwater; and, later in the same year, similar Old Red beds occurring in the limestones at Kilmacclenyn Hill, five miles N. N. W. of Mallow,—where the former rock forms a low and gentle sloping hill, having the latter dipping away from it in every direction.

Leaving Cahernane Demesne, the next place where the marble layers are observed is at the low point on Ross Island shore, due north of the Rough Island, and eventually they appear, for the last time, on the south-west shore of Ross Island.

It will be recollected, that tracing out the geological horizon afforded by these marble layers is of the utmost importance in determining the relative position of the limestones of the Lower Lake.

The shaly and cherty limestones forming the western extremity of Ross Island are so contorted as to become inverted in dip, being folded back over to the north, and consequently dipping S. at various angles, forming V and S-shaped curves; and at O'Donoghue's Library, black shales, evidently a portion of the Carboniferous Slates, occur; the same beds are observed forming Innisfallen Island, and with the same mode of occurrence, as can be well observed on the west shore of that island, when the lake is at a low level. Brown or Rabbit Island presents higher beds than those last described, the limestones being less shaly, and the black chert arranged in more definite layers.

Returning to the description of the Old Red Sandstone, he remarked that to the west of Brickeen Bridge the middle and lower beds were cut off by the Brickeen fault, and on the west of the fault, by an upcast, the purple or middle Old Red is brought to abut against the upper, and the Carboniferous Slates with the limestones are completely cut off. Mr. Du Noyer observed that Muckross Peninsula was a locality of peculiar interest to the geologist, as it presented what might be termed an epitome of the entire of the Carboniferous and Old Red Sandstone rocks of the south of Ireland. The Brickeen Island fault is therefore one of the best marked and most important of the district. The Upper Old Red is now lost, and it is not till we get on Dinish Island that it is again observed, when, by repeated inverted rolls of the beds, it is made to spread over the northern, western, and southern portions of the island. If we now cross from Brickeen Island to the boathouse on the Glena shore, under the cottage, we get into quite a different set of beds from those we have just left, though the distance is only 300 feet, the rocks agreeing in their strike. Along the west side of the island we had light greenish-gray grits in abundance, with but few dull purple slates; while, on the opposite shore of Glena, we can find nothing but soft purple slates and purple grit, without a single greenish-gray bed. We have therefore evidence of another N. and S. fault, which he named the Glena fault, on the west side of which, by an upcast, the upper Old Red is again brought to view, to the south of Glena Mount.

Proceeding south from Glena Cottage, we rapidly pass out of the purple slates and grits of the middle Old Red, and get on to the upper beds. These can be traced up the wooded stream which flows from the south flank of Glena Mount for the distance of 2000 feet westerly from the fault; leaving the stream from the point named, the same beds can be traced still farther for the distance of 1000 feet, where we come on the purple grits and slates of the middle Old Red; both groups of rock having a southerly dip at angles varying from 30° to 40°. Here the upper Old Red curves round to the east, and after repeated flexures of the beds along their line of boundary with the subjacent rocks, they eventually strike east, and abut against the Glena fault; all the observed dips over this portion of the upper Old Red are to the south, at from 30° to 40°, but here a refolding of the beds on each other is evident, which spreads them out to the extent of 2500 feet, in a north and south direction. Their normal thickness, however, of 400 feet, as measured in Muckross Demesne, would be quite sufficient to cover this extent of surface.

It is a remarkable fact, and one which is not sufficiently accounted for, that, on the west of the Glena fault, the upper Old Red rests conformably on the middle purple beds, while the latter are totally wanting on the east of the fault, the upper beds there resting on greenish-gray grits, with a few purple slates through them;—rocks in short, partaking more of the character of the lower Old Red Sandstone, to be presently described.

The Dinish Island upper Old Red extends as far south as the old weir bridge, where many sharp refoldings of the beds can be seen, giving a very good idea of the mode in which these rocks occur, to the west, as well as on the south shore of Torc Lake, where they lie at the base of Torc Mountain. The upper Old Red rocks which form the northern base of Torc Mountain can be best observed in ascending the stream forming Torc Waterfall; they consist of flaggy and irregularly bedded yellow and brown grits, with a few purple slates, light green shales, and light brown sandy layers, and light brown sandstones with purple slates; these beds are contorted repeatedly. Over Torc Waterfall are grayish-yellow flaggy sandstones; greenish-yellow shales; yellowish-brown quartzose grits, with purple slates: all these rest on the lower Old Red Sandstone, greenish-gray grits and purple slates, both being inverted in dip, that is, inclining to the south at 20°. The upper Old Red rocks, just described, stretch along the north flank of Torc Mountain, westerly, for the distance of about 2200 feet, when they are cut off by a fault striking in a N. and S. direction, from the "Quay" close to Torc Cottage; by an upcast to the west of this fault, their boundary is shifted to the north, for the distance of probably 500 feet; a second north and south fault, to the west of the one last observed, occurs near the boundary of Torc townland. This can be well observed in the stream forming this boundary; and the upper Old Red beds included between these two faults are much contorted, as can be well observed along the road skirting the Lake, where conglomeritic layers occur in the yellowish-gray grits, the pebbles being quartz, and occasionally jasper. The result of the second fault is also an upcast on its west side, which again throws the boundary of the upper Old Red more to the north, at the distance of 1300 feet westerly; from the second fault we find a third fault, having the same general direction as the others, and, like them, shifting the beds to the north; and still further to the west, there is again a fourth fault, which produces precisely the same results as the others. In this manner the upper Old Red thins out, as it were, on the north flank of Torc Mountain, and appears but as a narrow band as we approach Dinish Island from the east. This fourth fault Mr. Du Noyer believed to be a continuation of that previously described, and named the Brickeen Island fault; it is therefore one of considerable magnitude and importance, producing so great an upcast on its western side as to bring to view the middle beds of the Old Red Sandstone in many places along the east shore of Dinish Island.

The beds underlying the upper Old Red of Torc Mountain differ essentially from those on the opposite shore of the Torc Lake; there they consist of purple grits and slates, here they are greenish-gray grits and slates, with a few purple slates through

Dead-cow Cliff, Torc Mountain, Killarney, looking East.

them. The Torc Island boundary fault, and two others which occur at the Dead-cow Cliff to the west, have aided in producing a singular modification in certain contortions of the beds along the summit ridge on the north face of Torc Mountain; the general strike of the beds is here nearly east and west, but they are much contorted at the summit of the mountain; a short distance from it to the north, the crumpling of the beds begins to assume a definite arrangement, viz.:—a dip of from 70° to 85° north, suddenly changing to 25° south, and this along the line of strike of the beds for the distance of about 1500 feet; it appears that the crushing force here applied became so extreme, that the beds had a tendency to break along their strike, rather than bend, and being relieved by the Torc townland boundary fault on the east, and those at the Dead-cow Cliff to the west, they yielded along the strike of the synclinal curve, and formed an east and west fault. These beds, which dip at 25° south, abut against others, dipping 75° to 85° north, or often vertical; though faulted in this way, the amount of *vertical* dislocation may not be very considerable.

Proceeding now to Glena, and northwards along the shore, under Lady Kenmare's cottage, the only rocks we find are purple or liver-coloured slates and sandstone. At the point south of the rocky island called "Darby's Garden," is a broad band of thick-bedded, purple, conglomeritic sandstones, dipping S. 30°, resting on irregularly bedded and thick purple sandstones, with slates; and still lower in the series, at Slay and at Burnt Island are purple conglomeritic cornstones in the conglomeritic beds. Jasper pebbles frequently occur, and in cornstones the pebbles are purple grit and quartz, white quartz and jasper, in a rusty, calcareous, and sandy paste. When the cornstones are not conglomeritic, the calcareous portion consists of small lenticular layers, with a sandy or schistose matrix; and on exposed surfaces the rock assumes a dimpled appearance. Most of the purple sandstones extending from Darby's Garden to Stag Island are more or less calcareous. From the upper Old Red of Glena to the island just named, a distance of one mile and a quarter, none of the pale greenish-gray grits of Ardnagluggen Point in Muckross cross over to this shore, as their strike would suggest—a discrepancy which is the result of the upcast faults of Brickeen and Glena.

The summit of Tomies Mountain, 2414 feet, and that of Glena Mount, 2503 feet, exhibit purple grits and slates; at the latter there are many conglomeritic beds, similar to those near Darby's Garden on the Glena shore, and, like them, containing jasper pebbles.

If we now descend the south side of Glena Mountain, along the stream forming the parish boundary, and which falls into the upper Lake close to Arbutus Island, we find the purple grits and slates to continue for the distance of 2400 feet, and, when last observed, dipping N. N. W. at from 40° to 60°; here we at once pass out of these beds and get on green grits, with conglomeritic layers and green slates, all lying conformably under the purple beds just passed over; these I believe to be the upper portion of the lowest subdivision of the Old Red Sandstone, and the same rocks are persistent to the south, with some contortions, till they disappear in the Upper Lake. The best section of these lower Old Red beds is seen along the Kenmare road, at the base of Cromagloun Mountain; here the grits are often bright green, very hard, and many of them finely conglomeritic; these conglomeritic layers often consist of small scales of green and purple slate: the more decided conglomerates containing pebbles of jasper; purple and green slates are rather abundant in this section. All observed dips are southward from 35° to 45°, and the total thickness of the beds, as measured from near the lower lodge to the south of Stag Island Bay, cannot be less than 1500 feet; to this may be added 500 feet for beds observed at close intervals to the south, so that the section is increased to 2000 feet. As a mass, these beds curve round to the N. N. W., dipping from 65° to 75°, forming the promontory to the south side of the "Long Range," and presenting a series of salient angles pointing to the west, and passing through the centre of the Upper Lake, to its extreme western termination. At the head of the Upper Lake we have the same series of greenish-gray and green grits, and green and purple slates; though of course higher to the section than those last observed; and as they continue up the black valley, and form the base of the mountains on the north side, and the mountains themselves on the south, their absolute thickness may amount to 5000 or 6000 feet.

If from the head of the Upper Lake the ascent of Purple Mountain be made, 2730 feet in elevation, greenish-gray grits with conglomeritic layers, containing jasper pebbles, green and purple slates, with cornstones, are passed over, till, at the elevation of about 1100 feet, the upper purple grits and slates are again marked, precisely similar in character to those described as forming the upper portion of Tomies Mountain. All the beds here have a tendency to dip to the E. or N. E. at 40°, and the two groups are strictly conformable;

the pebbles of jasper ranging from the lowest to the uppermost of the conglomeritic beds; these can be observed on the very summit of Purple Mountain. Descending from Purple Mountain into the Gap of Dunloe, by the small lake called Glass Lough, and following the stream which flows out of it into the Gap, the upper purple grits and slates are observed to dip with tolerable steadiness to the east, at 20° to 25°, for the distance of about a mile and a half; nor do we get out of these purple beds till we descend to the elevation of about 1000 feet, or 413 feet above the level of this portion of the Gap; we have, therefore, passed through a thickness of purple grits and slates, amounting to 1730 feet, as determined by the elevations given on the Ordnance Maps; but if we measure by the probable stratigraphical thickness, we have from 2000 to 2300 feet as the most probable amount.

In the Gap of Dunloe, below the beds just described, we again find the greenish-gray grits, with conglomeritic layers, cornstones, and purple and green slates; these appear at both sides of the Gap with the same strike and angle of dip, viz.,—20° to 25° E. At the west side of the Gap the boundary line between the lower and the middle beds of the Old Red is about 250 feet higher than on the east, as would be the case if the beds on either side were projected across. Hence it is evident that the Gap of Dunloe is a valley of denudation, excavated along the strike of the beds.

Proceeding north through the Gap, the lower beds continue till we reach the southern extremity of the Black Lake. Here, on the east side they are observed to move round to the N. E., having the upper purple beds above them, which form the needle-like pinnacles called Tomies Rocks; and on the west of the Lake they appear to be cut off by an east and west fault, which, like that at Glena, brings the upper purple beds abutting against the lower greenish grits.

All the rocks round Cushavally Lake in the Gap are lower green beds; and, at the fault observed to the south of the Black Lake, these beds have a dip to the S. S. W. at 15°, with upper purple beds abutting against them on the north.

The cliffs overhanging this Lake consist of purple grits and slates, with a few cornstones, having a wavy dip to the west of 25°; and the uppermost observed beds have thick purple conglomerates, with cornstones through them,—the pebbles being quartz, and occasionally jasper. Still more to the north, beyond Coosane Lake, the road is cut through a thick bed of dark purple conglomerate; close to the northern entrance to the Gap these beds dip south, at from 60° to 70°, here the upper Old Red beds are observed, occupying but a small space, and beyond them, to the north, brownish purple grits set in, which Mr. Du Noyer thought should be included in the middle Old Red Sandstone; the upper Old Red is therefore probably contorted out of its proper line of strike, and, with the associated beds of the middle Old Red, *inverted* in dip, thus forming an **S** curve at this part of its boundary line.

If we now make the ascent of the Reeks from the southern extremity of the Gap of Dunloe, we pass up the southern face of Drishana Mountain. As usual in the low grounds of this district, we find greenish-gray grits, with green and purple slates and conglomeritic layers in the grits; and it is not till we reach an elevation of 1400 feet or so, that we again come on the upper purple grits and slates, quite free from all green layers. The purple beds continue till we arrive at the most eastern summit of the Reeks, 2398 feet, and are persistent along the range dipping S. at 40°,—the crest of the mountain following accurately a series of regular contortions in the beds which twist them, from S. 40° to W. and N. W., and finally S. S. W., at the same angle.

The Reeks having now reached the elevation of 3062 feet, the summit ridge having an average strike of E. N. E., suddenly turn sharp round, and strike S. for the distance of 1000 feet. Here a singular prospect opens on the view,—a bare rocky peak, still higher by probably 100 feet, rises directly to the south, perfectly precipitous on its eastern face, where the edges of the purple grits and slates are observed to be contorted along their line of strike; while, on its western side, the smooth bed-surfaces of the rocks, as they dip in that direction, slope downwards, and form the precipitous cliffs overhanging Lough Cummannapeasta, lying 1100 feet below. This peak of the Reeks is so rugged and steep as to be quite inaccessible. He here remarked, that the pinnacle at the head of the Hag's Glen, N. E. base of Carrantwohill Mountain, called Stoompanaduff, the termination of a rocky ridge, is equally inaccessible. The entire summit ridge of the Reeks consists of purple grits and slates.

At the head of the Hag's Glen are the Lakes Gourach and Callee, the former being exactly half a mile east, in a direct horizontal line, from the summit of Carrantwohill Mountain, which is 3414 feet in elevation. The level of this Lake above the sea is 1126 feet, and the rocks surrounding it are all purple grits and slates,—the middle subdivision of the Old Red Sandstone. Here again is obtained a natural section of these beds, amounting to 2238 feet, of vertical elevation, but if measured at right angles to the beds which dip, it would be increased to fully 3500 feet. Now all the rocks in the Hag's Glen to the north are those of the middle Old Red, and, as they dip westerly from 10° to 40°, they, of course, are higher beds than those last alluded to; and, consequently, the absolute observed thickness of the middle Old Red may be estimated here at 4000 feet.

From the foregoing observations it is clear, that in this district of the county of Kerry we have a development of the middle subdivision of the Old Red Sandstone (taking the Yellow Sandstone of Dr. Griffith as the upper), which, *per se*, would be quite sufficient to form the mountain ranges of the Knockmilldowns, the Galtees, the Mushera, the Cummeragh, or other Old Red mountain ranges in the south of Ireland, supposing the beds to be horizontal. Hence we have a strong argument in favour of the supposition that, wherever in the south of Ireland purple beds alone form the mass of the Old Red Sandstone, they should be regarded merely as the middle subdivision of that group. Such appears to be really the case, for in the districts of Ballyvourney, Gougane Barra, and Inchigeelagh, county of Cork, the green and greenish-gray grits and slates, with occasional purple slates, similar to those described as the lowest beds of the upper Lake and Black Valley sections,—but devoid of the fine conglomeritic layers observed so frequently in the latter rocks,—are the lowest beds in all the well-developed sections, and pass gradually and conformably into the purple grits and slates.

From having examined the Old Red Sandstones in the county of Waterford and Wexford, as well as in the county of Cork, at Mitchelstown, Mr. Du Noyer stated, that wherever he found it resting on the Silurian rocks, it lay unconformably on them; that its lowest beds were formed of coarse and fine conglomerates derived from the Silurian; that these conglomerates contained jasper pebbles; that they were often green in colour; and were split up by green and purple grits and slates. Therefore he saw, as yet, no reason why the green and greenish-gray conglomeritic grits, with green and purple slates, of the Lake district of Killarney, should be regarded as Silurian.

It appeared to him that in this district there was a better development of these, the lowest subdivision of the Old Red Sandstone, than he had observed elsewhere in the south of Ireland.

Directly N. W. of Lough Gourach, in the Hag's Glen, is a remarkable peak of rock called Stoompanaduff; and lower down the glen are the pyramidal masses called "The Hag's Teeth, Great and Little." These are evidently what would be called Needles, if they occurred on a coast line, and have been formed by the denuding power of the drift sea. Here the purple grits and slates have a dip to the west, of 10° to 25°, and are traversed by joints running nearly N. and S., E. and W.; the action of sea-breakers on such strata caused the mass to wear away on the cross joint, leaving pinnacles such as we now see standing out from the face of the cliff.

Descending from the summit of Carrantwohill on the south, to Lough Currachmore, which lies at the head of the northern spur of the Black Valley, a third natural section of the middle or purple part of the Old Red Sandstone is obtained. The summit of Carrantwohill is 3414 feet; Currachmore Lake, which is surrounded by these beds, is 1004 feet above the sea: hence the vertical section is 2410 feet in thickness, increased, if measured at right angles to the beds, to about 4000 feet; by adding the thickness obtained by this section to that of the Hag's Glen, a total amount of probably 5000 feet may be assumed as the thickness of the middle subdivision, or purple grits and slates of the Old Red Sandstone, in this locality. Allowing, therefore, 400 feet as the thickness of the upper Old Red or "Yellow Sandstone" of Muckross, and, say, 5500 as that of the lowest subdivision, or the greenish-gray grit with conglomeritic layers of the upper Lake and the Black Valley—we have a total of 10900 feet, as the observed thickness of the Old Red Sandstone formation of the Killarney district.

Proceeding down Curraghmore Glen, along the N.E. base of Sugarloaf Mountain, the lower Old Red rocks are alone observed; but, on making the ascent of this mountain, which is 2449 feet in elevation, we soon pass into the middle purple grits and slates which form the main mass of the hill, lying in a kind of trough in the lower beds, but in every instance strictly conformable to them.

The entire of the mountain ranges which now strike south by Lough Duff, the most westerly of the Black Valley Lakes, to the road leading to Lough Brinn, are composed of the middle purple beds; at half a mile east of Lough Duff, in the Black Valley, the lower green beds are again observed, and they occupy the entire of the Black Valley.

Brassil Mountain, 1888 feet in elevation, in the Black Valley, and to the east of Sugarloaf, presents the same geological structure as Sugarloaf. On the summit levels of the Knocknabreda range, which skirt the Black Valley on the south, a certain set of beds occurs, partaking of the character of the lower as well as middle subdivisions; these may be about 350 feet in thickness.

If we traverse south from the Black Valley, across the rocky range of Knocknabreda, as far as Wind-gap, on the Kenmare and Killarney road, the lower green beds, with a few purple slates and conglomeritic layers, containing jasper pebbles, are alone observed; but as we descend the mountains on the Kenmare side, the rocks, after some well-marked synclinal and anticlinal curves, dip conformably under the middle purple grits and slates which form the mass of the mountain ranges on the north of the Kenmare valley.

From the foregoing observations, it is clear that the Black Valley, with its branch to Curraghmore Lake, are valleys of denudation; the boundary between the lower and middle subdivisions of the Old Red, as proposed by Mr. Du Noyer, forming a contour line, varying from 1000 to 1350 feet above the sea.

In describing Mangerton Mountain, he remarked, that at the south entrance to the Devil's Punch-bowl, there occurs a boss of intruded felstone trap, about 500 feet in width, from N. to S. On the north side, the trap is very hard and compact, of a dull, purplish-gray colour, and slightly porphyritic,—the crystals being pale, yellowish-green felspar. It has a rudely laminated structure on the outer surface, where it comes in contact with the purple and green beds of the Old Red Sandstone. In the centre of the mass, the felstone weathers out in small spheroidal nodules; on the south side the felstone becomes flaky, passing into a green and ashy-looking rock, which weathers out in small dimple-shaped hollows; throughout, this trap weathers white.

This is the only instance of the occurrence of a trap rock in the district described, but in the Horse's Glen, to the east of Mangerton, dykes and bosses of greenish-gray felstone are of common occurrence.

The most remarkable protrusion of trap in the neighbourhood of Killarney is one first observed in the year 1855, by Mr. Fred.

Foot, of the Geological Survey, in the district placed under his examination; lying to the east of Mangerton, it forms the main mass of Bennaunmore Hill, one of the range of mountains lying directly south of Lough Quitane. In extent it is three-quarters of a mile from N. to S., and about a quarter of a mile E. and W. These traps are green and greenish-gray felstones, often porphyritic; and along the gorge to the east of Bennaunmore, they form magnificent ranges of columns from fifty to sixty feet in perpendicular height; in one place these columns are traversed by a dyke of pink felstone, six to eight feet in thickness.

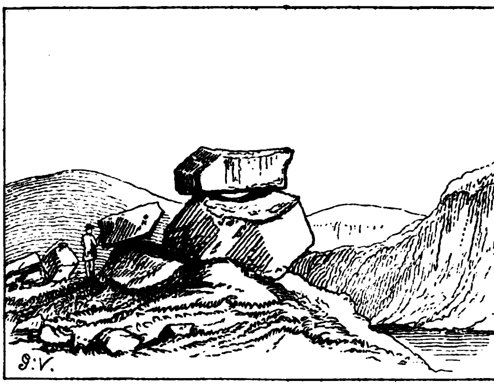
Columnar Felstone, east face of Bennaunmore Hill, south of Lough Quitane, Killarney.

I shall not attempt further details connected with this most interesting locality, as I believe it is the intention of Mr. Foot to bring a notice of it before this Society.

The rocks observed at the Devil's Punch-bowl belong apparently to that portion of the Old Red between the lower green and middle purple beds, and are faulted in a N. W. direction, at the cliffs to the east of the Lake.

In alluding to the trap rocks, Mr. Du Noyer called attention to a protrusion of fissile brecciated, as well as compact greenstone, occurring in the midst of the Carboniferous Limestones in the parish of Subulter, three miles east of Kanturk; it forms a hill of about half a mile from N. to S., and a quarter of a mile from E. to W., having the limestone dipping away from it in every direction. His attention was directed to this interesting fact by Sir Denham Norreys, of Mallow Castle, to whom is due the credit of having first observed this trap more than fifteen years ago, and it has not been recorded on any Geological Map.

In alluding to the drift of the Killarney district, he remarked the occurrence of large, angular, perched boulders of green grit, on the top of the mass of coarse angular drift which lies directly to the north of the Devil's Punch-bowl, and which dams up the water of that singular lake. These perched rocks occur at a height of



Perched Boulders of Green Grit, summit of mass of angular debris, north side of Devil's Punch-bowl Lake. Elevation of Boulder above the sea, 2319 feet.

2319 feet above the sea, the greatest elevation at which such boulders are observed in this district. The sea of the glacial drift period, must, therefore, have covered this spot in sufficient depth to have floated ice blocks capable of bearing and transporting boulders of many tons in weight.

If now we suppose the sea, at this presumed level, to have extended over the district just described, we find that the summits of Purple Mountain, Tomies, the Reeks, Carrantwohill, Benkeeragh, Skregmore, and Sugarloaf Mountains would have formed a group of islands, extending in an E. and W. direction, with the Black Valley as a deep sea channel, and the Knocknabreda and Cromagloun ranges as rather shoal water. It was remarked that the summits of the hills just named are all regularly escarped, and covered with *angular débris*, or shingle, the result of atmospheric rather than of aqueous agency.

When we descend the mountains from their tops to about 2300 or 2000 feet, we find many blocks more or less water-worn, and the sides and summits of the hills more or less rounded. Hence we are enabled to determine the amount of elevation to which this portion of the county of Kerry has been subjected since the period of the ice-bearing sea.

It is remarkable that Mangerton Mountain, though 2756 feet in elevation, presents a marked difference in outline to those less elevated peaky summits,—Purple Mountain, Tomies, and Skregmore; it is quite rounded on all sides, and flat for a considerable extent on its summit. This, however, may be accounted for, by supposing a difference in the original form of the mountains and valleys before the period of the glacial sea.

The surface of all the rocks in the Black Valley, as well as on the flanks of the adjoining hills, and along the shores, and on the islands of the Upper Lake, are all smoothed and striated, in lines and small furrows, running east and west, or parallel to the longest axis of the valley. All detached rock masses are rounded so as to form noses facing the west, a fact which determines the direction of the drift in this locality,—though such currents may have been merely local. The theory of a great northern drift is not invalidated by these observations; because, in the flats along the northern flanks of the chain of mountains which extend from Carrantwohill to beyond Mallow, boulders of porphyritic and syenitic granite are frequently observed, especially on the coal-measures and limestones to the north of Mallow. Mr. Du Noyer remarked that in the limestone gravel close to Clonmel, county of Tipperary, he had formerly observed a rounded lump, from the "Greensand," or mulatto stone of the county of Antrim, containing its characteristic fossils,—the most easily detected of all the cretaceous rocks of the north of Ireland. At the period of the last elevation of the Reeks, Carrantwohill, and the adjoining mountains, the current set in from the west and south, and at the place now called the Gap of Dunloe, a branch current to the north ran through it from out of the Black Valley; all along this valley the rocks are striated north and south in many places. When the lower green grits at the south of the Gap came to be acted on, they resisted the wear and tear of the sea, deflecting the current to the east so as to leave the head of the Gap dry land; the whole force of the water was now applied against the west flank of

Torc Mountain, and here we observe the glacial striæ running straight up its side.

To the east of Cromagloun Cascade is deposited an enormous accumulation of drift, arranged in lunette masses, and filling up what was once a bay half a mile wide, on the S. W. flank of Torc Mountain; all the *débris* here observed has been derived from the mountains to the west. The current now struck north, wearing away the east side of Glena Mountain, along with the limestones of Torc Lake. The mass of drift thus produced, as well as that carried from the northern faces of the Killarney range, appears to have been swept easterly towards Millstreet, forming that extraordinary and vast accumulation of drift observed at the mouth of Glenflesk, and in that neighbourhood.

In these latter observations, Mr. Du Noyer wished to guard himself against being supposed to maintain the opinion that these drift accumulations and glacial effects were the result of sudden action, since they are quite explicable on the supposition of a comparatively tranquil agency, continuing over an indefinite period of time.

THE Society met on the 12th of March, 1856, on which occasion the following Paper was read.

RESEARCHES AMONG THE PALÆOZOIC ROCKS OF IRELAND, WITH A VIEW TO DETERMINE THE LIMITS OF THE OLD RED SANDSTONE, AND ITS RELATION TO THE INFERIOR ROCKS. BY JOHN KELLY, ESQ.

IN the present paper, the division of the Palæozoie rocks to be principally treated of, is that called the Old Red Sandstone. This rock appears to have been recently mistaken for others, and as we have four or five sandstones, it becomes necessary to define clearly which of them is the one under consideration,—as, whatever division of the crust of the earth first got the name, should be the one entitled to retain it. I shall begin by quoting a few sentences from the works of geologists, to show what was understood to be the Old Red Sandstone a few years ago.

Dr. Mac Culloch, in his "Treatise on Geology," published in 1831, at page 288, vol. i., says:—"The lowest bed of the secondary strata in England is the Old Red Sandstone, being the first of the secondary rocks in the artificial classification; it must not, however, be considered as a simple rock, since, besides the conglomerate which is essential to it, it sometimes contains shales and limestones, and occasionally coal. The next bed in the order upwards is a limestone containing a few fossil remains, and known by the name of Mountain and of Carboniferous Limestone."

Professor Phillips, in his "Geology of Yorkshire," gives a Table at page 11, in which he divides the Carboniferous system into three principal parts: the Coal Formation, Carboniferous Limestone, and Old Red Sandstone; and he says:—"The Carboniferous system does undoubtedly permit itself to be considered in three series, characterized by the prevalence of coal, limestone, and Red Sandstone." In his "Geology" in the Cabinet Cyclopædia, he adheres to the same subdivisions, and calls it "a triple system."

The descriptions given by those writers appear clear and satisfactory, and point out distinctly their idea of the position of the Old Red Sandstone; and I would say, their views on the subject do not appear to me to require any alteration or modification; and I therefore adopt the position and the type of that rock, as pointed out by them.

In Ireland the Carboniferous formation is divided into a similar triple system; and though its subdivisions everywhere differ widely from each other in lithological appearance and mineral character, yet the whole system is characterized by the remarkable circumstances: —1. That the strata of which it is composed rest unconformably on whatever rock lies below them; 2. That they are covered unconformably by the overlying rock; and, 3. That they are parallel to one another, or lying, as it were, in one bundle: thus, though in three groups of different mineral character, yet clearly pointing to one geological epoch, in which the whole suite, from beginning to end, was deposited, without any great catastrophe or disturbance, in its position or succession. Wherever we can see a clear junction or a good section, we generally find the beds of the older, or underlying rocks, thrown up on their edges, at a steep angle; while the beds of the Carboniferous system lie on them at a comparatively low angle, and often nearly level.

The Old Red Sandstone may itself be divided into three parts, differing from each other chiefly in lithological appearance:—

1. The first or lowest is usually a band of red conglomerate, composed of rounded pebbles of white quartz, brown quartz, purple horn-

stone, jasper, and fragments of other rocks, united into a hard mass by a mineral paste or matrix. The pebbles are sometimes hardly set in the cementing matter, and sometimes so loose as to be easily detached by a blow of the hammer, leaving a smooth cavity. In this part there are sometime alternations of red sandy beds, almost without pebbles. In some localities there are in the mass rounded stones of mica slate, with very little else, as at Cushendall, or green chloritic slate or green grit, as at Lane, near Skerries. Its whole thickness varies in different places from 20 to 100 feet.

2. Next comes a series of Red Sandstones, and red shales, in alternate bands, between 200 and 600 feet thick.

3. The upper part is composed of thick beds of sandstone, mostly of a whitish or yellowish colour. This upper part of it is the Yellow Sandstone of Mr. Griffith. It sometimes contains thin beds of limestone, or thin gray or red bands of calcareous slate or shale, interstratified with the sandstone; those beds of limestone and slate all contain the usual fossils of the mountain limestone. The yellow part of this sandstone is from 50 to 200 feet in thickness, and sometimes contains a few of the fossils.

A good type of this rock is visible at Templetown, near Hook Head, in the county of Wexford, where it is exposed in a coast section, and the bottom and the top are clearly seen.

The typical character is often, however, different from this at Hook Head. In the North of Ireland the prevailing colour of the rock is red; so it is in the eastern part of Tyrone near Cookstown, in Down at Castle Espie, and at Armagh; while in the South and West of Ireland the yellow colour prevails: this is the case in the King's and Queen's Counties, where this rock is seen mantling round the Slievebloom Mountains, near Mountmellick, Kinitty, and Roscrea; in Tipperary, at Borrisoleigh and Cappawhite; in Clare, round the Derrybrian Mountains, near Woodford, Gort, and Scariff; and in Kerry, at Kerry Head, and Slievemish near Tralee. I may add, that on the east side of Knocksheegowna, near Borrisokane, there is very little Red Sandstone at all, the rock being yellow to the lowest beds visible, and at Toberelathan, six miles S. W. of Loughrea, a yellow colour prevails, even in the lower beds of the conglomerate, and here there is a clear and good section.

I have just stated that the Old Red Sandstone lies unconformably on the rocks which support it. This, in Ireland, is generally gray clay slate, interstratified with gray grit beds, the old grauwacke series, which includes both Cambrian and Silurian rocks, but it sometimes rests on other rocks, as I shall show.

To point out more clearly some of the facts supporting the views I take, I have drawn up the following Table, which shows in several localities the dip of the supporting rock near the junction, and the unconformable dip of the sandstone, as set out in the headings of the columns. It rarely happens that a good junction with the two kinds of rock can be seen; but in the greater number of cases the observations are made within a short distance of each other, and since the beds of the Carboniferous formation throughout are parallel to one another, two different rocks, visible at spots, even a furlong distant, can be known to be conformable or otherwise, where no sign of undulation or disturbance is visible in the vicinity. I begin with the northern counties, and proceed southward:—

TABULAR LIST OF LOCALITIES IN IRELAND, *where Junctions occur, of Old Red Sandstone, with the Rocks which lie beneath it.*

No.	County.	Townland, with Distance and Direction from the nearest Post Town.	Underlying Rock and Dip.	Dip of Old Red Sandstone.
1	Mayo, . . .	Conaghra, 5 miles W. of Ballycastle, . . .	Stratified quartz rock, S.E. 25°,	N.E. by E. 20°.
2	"	Briska, 1 mile S.E. of Bangor, ...	Quartz rock, N.E. 70°,	E. 5°.
3	"	Derrycleetagh, 1½ mile N.E. of Newport, .	Mica slate, N.W. 20°,	S.W. 10°.
4	"	Tevenish West, 10 miles S. of Castlebar, .	Mica slate, S. 30°,	S.E. 10°.
5	"	Cloonagleragh, 4 miles N.E. of Castlebar, .	Mica slate, N.W. 80°,	S.E. 15°.
6	"	Ballaghaderreen, ½ mile W. of the town, . .	Brown slaty porphyry, N. 60°,	S. 10° to 20°, thin yellow beds.
7	Sligo, ...	Lugnaduffa, 7 miles W. of Ballysadare, .	Mica slate, S. 25°,	Level.
8	"	Clonacool, 13 miles S.W. of Cooloony, . .	Mica slate, N.E. dip,	S.E. 15° to 30°.
9	Donegal, . .	Ballykilowen, 11 miles N.E. of Ballyshannon,	Mica slate, N.E. 50°,	S.W. 20° to 15°, limestone near.
10	"	Cormullin, 8 miles N.E. of Ballyshannon, .	Mica slate, N.W. 60°,	N.W. 25°.
11	"	Coolcholly, 1 mile N.E. of Ballyshannon, .	Mica slate, N.W. 40°,	N.W. 18°, dolomite.
12	Londonderry, .	Drung, 10 miles N.E. of Londonderry, . .	Mica slate, strike N.E.	E. 20°.
13	"	Drumcovit, 3 miles S.W. of Dungiven, . .	Mica slate, N.W. 50°,	E.S.E. 5°.
14	"	Tirkane, 4 miles N.W. of Maghera, . . .	Mica slate, N. 30°,	E. 30°.
15	"	Doon, 2 miles W. of Draperstown, ...	Mica slate, W. 45°,	E. 15°.
16	Tyrone, . . .	Grouse Lodge, 4 miles N.E. of Pettigo, . .	Mica slate, N.E.,	S.E.
17	"	Seegronan, 6 miles S.W. of Castlederg, . .	Mica slate, S.E. 60°,	S. 30°.
18	"	Derrygoon, 4 miles N. of Drumquin, . . .	Mica slate, W. 50°,	S. 15°.
19	"	Rossnamuck, 4 miles N. of Omagh, . . .	Mica slate, N.W. 80°,	W. 40°.
20	"	Lisky, 4 miles N.W. by N. of Newtownstewart,	Mica slate, N.W. 20°,	S.W. 35°.
21	"	Kildress, 3 miles W. of Cookstown, ...	Greenstone,	E. 10° to 30°.
22	"	Latbeg, 2 miles N.W. of Clogher, ...	Brownstone, N.W. 40°,	S. 20° on Eskermore.
23	Antrim, . . .	Gortnagross, 1 mile S.W. of Cushendall, . .	Mica slate, S.W. 35°,	S.E. 10°.
24	Down, . . .	Castle Espie, 2 miles S.E. of Comber, . . .	Gray clay slate, vertical,	N. 15°.

No.	County.	Townland, with Distance and Direction from the nearest Post Town.	Underlying Rock and Dip.	Dip of Old Red Sandstone.
25	Down, . . .	Carrowreagh, 3 miles W. of Newtownards, .	Gray clay slate, S.E. 70°,	S. 10°.
26	"	Craigavad, 4 miles N.W. of Newtownards, .	Gray clay slate and grit, S.E. 80°,	N.W. 10°.
27	Armagh, . .	Drumadd, ½ mile E. of the town, ...	Gray clay slate, S.E. 45°,	N.W. 15°.
28	Fermanagh, .	Coolbuck, 2 miles N.E. of Lisbellaw, . . .	Gray clay slate, N.W. 50°,	S.E. 15° to 20°.
29	"	Glengesh, 4 miles N.E. of Tempo, ...	Brownstone, N. 20°,	S.E. 5°.
30	Louth, . . .	Kilcurry, 3 miles N.W. of Dundalk, . . .	Gray clay slate and grit, vertical,	E. 10°.
31	"	Plaster, 3 miles N.W. by N. of Dundalk, .	Gray clay slate & gray grit, N.W. 80°,	S.E. 15°.
32	Cavan, . . .	Cullees, 2 miles N. of Cavan, ...	Gray clay slate, E. 40°,	W. 10°.
33	"	Drumany, 2 miles S.W. of Killeshandra, .	Gray hard grit, S. 50°,	Level at Portlongfield.
34	Meath, . . .	Maperath, 3 miles N.W. by N. of Kells, . .	Gray clay slate & gray grit, N.W. 70°,	E. 15°.
35	Dublin, . . .	Portrane Pier, 4 miles N.E. of Swords, . .	Greenstone,	N.W. 25°.
36	"	Lambay Island, 10 miles N.E. of Malahide,	Greenstone,	N. 60°.
37	Kildare, . . .	Barnacrow, 5 miles N.W. of Newbridge, . .	Greenstone,	N.E. 20°.
38	"	Grangeclare, 3 miles N.W. of Kildare, . .	Gray clay slate, S. 70°,	N. 12°.
39	Longford, . .	Farnagh, 1 mile S. of Longford, ...	Gray clay slate, N.W. by N. 65°,	W. 3°.
40	"	Knocknahaw, 1 mile S.E. of Longford, . .	Gray clay slate, N.W. 80°,	N. 3°.
41	"	Gaigue, 2 miles N.E. of Drumlish, ...	Gray clay slate, S.E. 35°,	Level.
42	Leitrim, . . .	Corduff, 6 miles E. of Mohill, ...	Clay slate, strike S.W.,	S.W. 10°.
43	Roscommon, .	Cornaglia, 3 miles N.W. of Boyle, ...	Brownstone, N. 10°,	S. 7° at Ballinphuil.
44	"	Derryherk, 4 miles N.E. of Boyle, ...	Gray grit, N.W. 5°,	S.E. 20°.
45	Galway, . . .	Derrylaura, 1 mile N. of Oughterard, . .	Granite,	S.E. 20°.
46	"	Cregganor (Toberelathan), 6 miles S.W. of Loughrea, ...	Gray clay slate, E. 60°,	N.W. 45°.
47	"	Ballycuddy, 4 miles S.W. of Loughrea, . .	Gray clay slate, E. 70°,	N.W. 50°.
48	King's Co., .	Cummer, Lower, 1½ miles S. of Kinitty, .	Gray clay slate, S.E. 70°,	N. 10°.
49	"	Aghagurty Bridge, 2 miles S.W. of Kinitty,	Gray clay slate, W. 70°,	W. 10°.
50	Queen's Co., .	Glenkitt, 8 miles W. of Mountrath, ...	Gray clay slate, N.W. by N. 65°,	S.E. 5°.
51	Kilkenny, . .	Ballygowan, 1 mile S.W. of Kilmaganny, .	Gray clay slate, strike S.W.	N. 20°.

No.	County.	Townland, with Distance and Direction from the nearest Post Town.	Underlying Rock and Dip.	Dip of Old Red Sandstone.
52	Tipperary, . .	Gortanarible, 5 miles N.E. of Borrisokane, .	Gray grit, N.W. 70°,	E. 25° at Skehanagh.
53	"	Carrick, 2 miles S.E. of Moneygall, . . .	Gray clay slate, N.W. 65°,	S.E. 20°, limestone.
54	"	Knockanevin, ½ mile N.W. of Borrisoleigh,	Gray clay slate, S. 60°,	S.E. 25°.
55	"	Lackanacoombe, 2 miles N.E. of Cappawhite,	Gray clay slate and grit, S.E. 60°,	S.W. 10°.
56	"	Ahenny, 5 miles N.W. by N. of Carrick-on-Suir,	Gray clay slate, N.W. 60°,	S.W. 30°.
57	"	Rathclarish, 5 miles N. of Carrick-on-Suir,	Gray clay slate, N.W. 60°,	S.W. 30°.
58	Clare, . . .	Lecarrow Lower, 1½ miles E. of Feakle, . .	Gray clay slate, S.E. 25°,	Level.
59	"	Gortacullin, 1 mile S. of Broadford, . . .	Gray clay slate, S. 30°,	N. 10°.
60	Kerry, . . .	Ballyoughteragh (Sybil Point), 7 miles N.W. of Dingle, ...	Brownstone, S.S.E. 70°,	N.N.W. 60°.
61	"	Ballinahow (Coosathouick), 7 miles N. of Dingle,	Brownstone, S.S.E. 70°,	N.N.W. 60°.
62	"	Kinard, 4 miles S.E. of Dingle (Coosathurrig),	Brownstone, S. 80°,	Nearly level on average.
63	"	Glenteenassig, 4 miles N. of Aunascaul, . .	Brown micaceous flag, N.W. 65°,	N.W. 25°.
64	"	Doon Hill, 4 miles N.E. by N. of Aunascall,	Green grit, thick beds, W. 60°,	N.N.W. 30°.
65	"	Cummeen, 4 miles N.E. of Aunascall, . . .	Green grit and slate, W. 65°,	N. 30°.
66	"	Derrymore West, 8 miles S.W. of Tralee, .	Green grit and slate, vertical,	Nearly level.
67	Cork, ...	Quartertown, Upper, 1½ miles S. of Mallow,	Brownstone, average S.E.,	N. 15°.
68	Waterford, . .	Newrath, ½ mile N.E. of Waterford, . . .	Green grit, N.W. 80°,	N.W. 15°.
69	"	Glenhouse, 2 miles S.E. by S. of Portlaw, .	Gray slate, S.W. by S. 80°,	N. 60°.
70	"	Drumrusk, 2 miles S.W. of Passage, . . .	Green grit, N.W. 70°,	N.E. 20°.
71	Wexford, . .	Park, 2 miles N.W. of Wexford, ...	Gray clay slate, N.W. 40°,	E. 20°.
72	"	Rocksborough, 1 mile S. of Wexford, . . .	Quartz rock, N. 20°,	S.E. 20°.
73	"	Starvehall, 2 miles S.W. of Wexford, . . .	Quartz rock,	S.E. 20°.
74	"	Hodges' Mill, 5 miles S.W. of Wexford, . .	Mica slate, N. 20°,	S.E. 25°.
75	"	Duncormack, in the quarry at the village, .	Gray grit and slate, S.W. 20°,	S.W. 25°.
76	"	Nook, ½ mile N.W. of Ballyhack, ...	Gray clay slate, S.E. 30°,	N.W. 10°.
77	"	Templetown, 4 miles S.E. of Duncannon, .	Gray clay slate, N.W. 60°,	S.S.W. 15°.
78	"	Lambstown, 1 mile S. of Fethard, ...	Gray clay slate, 80°,	S.E. 15°.

I have in this Table recorded the dips of both rocks, at or near the junctions, in seventy-eight localities; and I might easily give double the number, were it not that, when I was employed on the General Valuation of Ireland in the north, though careful to note the dip at every opening of sandstone I met, I omitted in many instances to take the necessary pains to determine the dip of the mica slate or clay slate in the vicinity, as that is frequently obscure, from the cleavage of the slate, or from being covered with drift. This was more especially the case in the county of Tyrone, about Plumbridge, and thence along the southern bases of the Bessy Bell and Mary Gray mountains, towards Castlederg.

It will be seen also in the Table that, in those seventy-eight localities,—

The Old Red Sandstone rests on mica slate . .	in 19	cases.
On gray clay slate, ...	27	„
On gray grit, or quartzite, ...	3	„
On gray grit, interstratified with gray clay slate, .	6	„
On green grit, ...	3	„
On green grit, interstratified with gray clay slate, .	2	„
On brownstone, or brown hard grit, ...	7	„
On brown micaceous flag, with brown or purple slate,	1	„
On yellowish-white stratified quartz rock, . . .	2	„
On yellowish-white quartz rock, bedding obliterated,	2	„
On brown porphyry, ...	1	„
On greenstone, ...	4	„
On granite, ...	1	„

This abstract shows, perhaps more clearly than any other evidence I could adduce, that, after the great disturbing forces which rolled the earliest stratified rocks into such undulations, as we now find in them, followed by a powerful denuding agency, that broke up and carried away the tops of many of the anticlinal convolutions formed in them, and left the beds thrown up on their edges, the conglomerate of the Old Red Sandstone was the first layer, or foundation of a new building—the Carboniferous formation. This band was laid down upon those edges of the older rocks, as they happened to present themselves, whether slate, grit, quartz, limestone, or any other rocks, and whether gray, green, red, or brown. I look upon this band of conglomerate as a most important landmark, or index, in Geology; it is the boundary between two distinct periods of organic life, and, besides the changes in the genera and species of the animals that existed below and above it, there is a well-marked difference in the lithological character of the rocks also—the more ancient being much harder. Those hard grits, crystalline limestones, and clay slates, of the older period, have their representatives in the soft sandstones, ordinary limestones, and shales of the newer.

Grit and sandstone are two names which appear to be often used, one for the other, in Geology. Grit, in this paper, means a very hard, quartzose, rock, often green or gray, sometimes dark brown, and found in the older and lower sedimentary rocks, interstratified with green, gray, or purple slates, having a distinct cleavage. Those grits are generally very refractory under the hammer or chisel of the workman. Sandstone, on the contrary, is a soft, sandy rock, easily split into rectangular blocks, or chiselled for economic purposes. Sometimes it is red, sometimes yellow or white. Such in Ireland is usually got in the Old Red Sandstone, and in the Coal series.

In the foregoing Table, also, some of the localities exhibit points of geological interest, to those who may visit them, worthy of a few remarks. I shall notice them separately and consecutively, in the order in which they are numbered at the end of this paper.

In treating of this subject, it appears desirable to make an attempt at determining the thickness of this division of the Carboniferous system. It is not easy to get good sections of it, for it frequently happens that the bottom or the top is not clearly visible; the rock not always well exposed from being covered with drift, or there may be a fault, and consequent downthrow of the strata, and the surface made even afterwards by denudation, making it impossible to detect the fault. Therefore, the thicknesses resulting from sections can seldom be depended on for anything more than an approximation to the truth. I have selected a few of the best sections I know, and, from the heights given on the Ordnance maps, laid them down on the same scale of length and height, in the shortest line across the strike; then, measuring the thickness from the bottom to the top, I give the results as they turned out, in the following tabular statement:—

No.	County.	Locality.	Feet.
1.	Armagh, . .	At Annaclare, 2 miles N. E. of Armagh, .	1090
2.	Sligo, . . .	At Clonacool, 12 miles S. W. of Colooney, .	1020
3.	Roscommon, .	At Boyle, through the town, ...	740
4.	Galway, . c	At Toberelathan, 6 miles S.W. of Loughrea, .	430
5.	Clare, . . .	At Capparoe, 1 mile N.W. of Tomgraney, .	790
6.	" . . d	At Raheen, 1 mile S.W. of Tomgraney, . .	1460
7.	" . . .	At Killea Church, 4 miles N. of Limerick, .	630
8.	Tipperary, .	At Newtown, 3 miles N.W. of Nenagh, . .	1220
9.	" . .	At Ballywilliam, 3 miles S.W. of Nenagh, .	910
10.	" . .	At Birdhill, 10 miles S.W. of Nenagh, . .	1230
11.	" . .	At Curraghglass, 1 mile N. E. of Borrisoleigh,	1050
12.	Kilkenny, e	At Currahill, 1 mile W. of Kilmaganny, .	1680
13.	Wexford, . f	At Croats, 2 miles S.W. of Wexford, . . .	310
14.	" . f	At St. Lennan's, 7 miles S.W. of Wexford, .	260
15.	" . f	At Duncormack, 9 miles S.W. of Wexford, .	230
16.	" . g	At Templetown, 5 miles S. E. of Duncannon,	450

OBSERVATIONS ON SOME OF THE FOREGOING SECTIONS.

2. The section at Clonacool is on the south-east flank of the Ox Mountains. It ought to be a good average one. The red rock is well exposed in the river, the dips pretty regular, and the data generally good.

3. At Boyle, from the depth of the bed of the river below the land adjacent, that there may be a fault in this line. This would derange the succession in the section.

4. The section at Toberelathan, near Loughrea, is a good and clear one; both the bottom and the top of the band are visible there. The result of the measurement gives only 430 feet as its thickness, which appears very small. It is a remarkable fact, in the Carboniferous system in Ireland, that in the north the sandstones are thick, and limestone comparatively thin; while in the south the reverse takes place, the limestone is thick, and the sandstone thin. In the river at Kildress, near Cookstown, the Old Red Sandstone appears in the river for above a mile of its length, but there is so much disturbance in the strata, that a satisfactory section, as to thickness, could not be made. It probably exceeds 1000 feet. A

similar conclusion results from observing the volume of the sandstone at Scrabo, near Newtownards, in the county of Down, and at Armagh; while the limestone about Cookstown, perhaps, does not exceed 200 or 300 feet. Contrast this with the south. The sandstone at Toberelathan, as just stated, is 430 feet. The limestone at Black Head, in the county of Clare, immediately south of Galway Bay, shows about 1200 feet in thickness over the sea level, in one of the best exposed and least disturbed sections in Ireland, besides some under the water, the thickness of which is not known.

6. At Raheen, near Tomgraney, in Clare, I am inclined to doubt the result, 1460 feet. The section at Capparoe (No. 5), not two miles off, is only 790 feet, and this is backed by the section (No. 4) at Toberelathan, on the same band of sandstone, which, as just stated, is only 430 feet. The dip is low at Raheen, and, though the rock is visible at bottom and top, the section in the middle is covered with drift. A slight change of dip, from 10° to level, or an undulation under the drift, would nullify the result.

12. At Currahill, in Kilkenny, the result, 1680 feet, appears large, but I give it as it turned out. There is a change of dip in the section; it gets flatter proceeding northward, towards the limestone; and the point where the change from 25° to 20° takes place, is not clear.

13, 14, 15. The three sections, at different places, on the east flank of Forth Mountain, in Wexford, give the result as unusually thin. There may, possibly, be a fault along the south-east side of the mountain, near the edge of the quartz rock, in which some of the thickness may be buried. Indeed, there are grounds for supposing that the quartz rock mass of Forth mountain was pushed up, in the fact that, the tertiary blue marl of the county of Wexford, along its western or highest margin from Gorey, by Camolin and Enniscorthy, towards Wexford, is found at a general level of about 200 feet over the sea, with only one exception that I know, and that is on the eastern side of Forth Mountain, two miles south-west of the town of Wexford, where a patch of this marl, resting on quartz rock, occurs at a height of something above 300 feet. This fact affords a strong presumption that Forth Mountain itself was forced up above the general level of the country, since the deposition of the blue marl; and, if so, there must be a fault along the eastern boundary of the quartz rock, or near it.

16. At Templetown, near Hook Point, the rock is well exposed all the way on the shore, and yet the resulting thickness appears small; but there are two faults in this section, by each of which there appears a downthrow to the south, the amount of which cannot even be guessed at. This makes the result, in this section, too little. On account of the rock being well exposed, this is one of the best typical sections I know, and in the upper part of it, at Porter's Gate, the yellow sandstone of Mr. Griffith is particularly clear, and separated from the main body by a band of calcareous black shale, containing thin beds of gray limestone, both shale and limestone being full of the fossils of the mountain limestone.

The general average of the thickness of the Old Red Sandstone, as measured in the foregoing sixteen sections, is 840 feet. Taking out six of the most doubtful, that is, Nos. 6, 12, 13, 14, 15, 16, in the Table, the average of the remaining ten sections is 910 feet. Four of the best of them, viz., Nos. 1, 2, 9, 11, give an average of 1018 feet. In short, about 1000 feet may be considered as the thickness of this division. It will be at once apparent, that measurements of the thickness of this rock, in Ireland, fall very far short indeed, of the ideas of thickness derived from reading published accounts of the Old Red Sandstone of Great Britain.

Having thus, as well as I could, pointed out marks for the identification of this subdivision of the Carboniferous rocks, in the band of conglomerate at its base, its average thickness, and, above all, the unconformable position in which it lies on the supporting rocks,—I now come to consider the second part of my subject, that is, the relations of those older rocks among themselves.

The Dingle peninsula is the key of the geology of the south of Ireland. From the extent of sea coast and of rocks laid bare, I know of no place where they can be studied with more advantage, and the fossils they contain afford proofs of their true place, if doubt or obscurity existed regarding them. In no other place are found such clear junctions, or such decided proofs that the Old Red Sandstone, and the rocks on which it rests, are of two different epochs in the earth's history. I shall, therefore, enter on a short account of the Geology of that district.

Besides the New Red Sandstone, and the Old Red Sandstone, we have in Ireland another Red Sandstone, or grit, which, I have reason to believe, has frequently been confounded with, or mistaken for, the Carboniferous Old Red, which I have been describing. It is of true Silurian age, as I shall presently show. It is awkward to have two or three rocks, of two or three geological epochs, bearing the same name, Red Sandstone. This rock occurs in four or five other parts of Ireland, but it especially prevails in the south, where it is called by the peasants "Brownstone;" and as this appears an appropriate name, for colour at least, I adopt it, for sake of distinction, as a Silurian rock.

At Ferriter's Cove, on the coast, eight miles N. W. of Dingle, a band of gray slaty rock dips S. E., at an angle of about 70°, and is full of Silurian fossils. This band, from Doon Point, its N. W. extremity, across the strike, is about half a mile wide on the surface, or at this dip 2500 feet in thickness. A band of brownstone strata underlies this fossiliferous band, north-westwards to Sybil Point; where the Old Red Sandstone of the Carboniferous System covers it unconformably, dipping N. W. 60°. From the signal tower on the conglomerate, across the strike of the brownstone, to the fossiliferous slaty band, is 60 chains, and this, with a dip of 70°, gives a thickness of brownstone here of 3600 feet. The section is well exposed on the coast near Sybil Head; but the bottom of it is not seen, being under the sea level. The geological position of this brownstone is fixed, by its being found conformable with, and under, the Silurian fossiliferous band.

At Clogher Head, farther south on the coast, a greenstone protrusion interferes with the continuity of the strata; but in the stream near Doonquin old churchyard, six miles west of Dingle, a fossiliferous slaty rock, similar to that at Ferriter's Cove, dips southward, and is covered by brownstone and brown slate, alternating with green grit and green slate to Slea Head—a distance of nearly two miles and three-quarters: all dipping at a steep angle southwards, and conformable. This, at an average dip of 70°, would give a thickness of about 14,000 feet of those grits and slates over the fossils at Doonquin,—all part of the same system.

I have just said that the fossiliferous band at Doonquin appears similar to that at Ferriter's Cove. They are separated by some grit beds, and a greenstone protrusion; but, nevertheless, they may be parts of the same original band, and accounted for thus:—In the diagram which I now exhibit, suppose the earth's surface at this locality, at one time, to have stood at a higher level, shown by the dotted line *ghi*, than the present line from *a* to *f*. Then the fossiliferous band at *d*, represented by the white space *pmno*, was continuous; afterwards a fault on the line *hk* took place, and the portion between *g* and *h* slipped down to the position *abc*, and that part of the band between *m* and *n* was thrown down to *b*, and now makes, apparently, another band. Subsequently greenstone was protruded into the line of fault, between *c* and *k*, and that part of the surface between *h* and *i* was worn down by denudation to the present surface *cdef*.

Again, at Kinard, three miles S. E. of Dingle, the brown grits, and purple slates, at Coosathurrig, on the shore, contain Silurian fossils; the dip of the beds being S. 70° to 80°. This brownstone is surmounted, on the hill of Kinard, unconformably by a cap of Old Red Sandstone; the beds, on an average, lying nearly level, as stated before. This patch is of an oval form, a mile and a quarter long, in a N. E. direction, by a quarter of a mile wide. This locality affords a striking proof that the brownstone and the Old Red Sandstone are of two different formations, for I consider that the manifest unconformability of the beds of the two groups points out the true line of demarcation between the two systems, although both appear like Red Sandstone,—differing, however, in this circumstance, that the lower, besides the Silurian fossils, is more brownish, and very hard; the upper, more red and soft.

Pebbles of white vein quartz are frequently seen in the brownstone, along the coast, between the mouth of Dingle Harbour and Bull's Head; even in the vicinity of the Silurian fossiliferous band, and in the same group of strata, white quartz pebbles are also got occasionally in the green grits hereabouts—a circumstance worthy of noting, because it has been thought that those white pebbles are peculiar and characteristic of the Old Red Sandstone conglomerates, and not found in other rocks; but they do sometimes occur in brown and green Silurian grits, as in this instance.

Besides this cap of Old Red Sandstone at Kinard, there are several other places in the Dingle peninsula where the Old Red Sandstone conglomerate lies unconformably on the brownstone, or other coloured grits—I shall notice them separately:—

1. The first is at Sybil Head, a narrow strip of strong conglomerate, only a few yards wide, dipping N. W. at 60° into the ocean, as before stated, and covering the upturned ends of the brownstone beds unconformably along the shore for nearly a mile and a half in length.

2. On the east side of Smerwick Harbour it is visible at Ballydavid Head, forming also at this place a narrow band along the coast.

3. At Beenaman, in the townland of Ballinahow, skirting along the northern base of Brandon Mountain to Brandon Head, where it turns southward, and inland. These three strips, though separated by indentations in the coast, seem to be a continuation of the same band, composing the basal beds of the Old Red Sandstone, from Sybil Head to Brandon Head, a distance of ten miles. The rock is the same in lithological appearance in all those three patches, and in the magnificent coast view, looking from Beenaman towards Sybil Head, this band exhibits a remarkable uniformity of strike and dip the whole way.

4. Proceeding eastwards, the next in order is at Kinard, three miles S. E. of Dingle, which I have just described.

5. The conglomerate is visible on the summit of the hill at Hillville, four miles west of Castlegregory, forming a cap there also, in extent nearly a square mile.

6. At Gleenteenassig, four miles north of Aunascall, and eleven miles E. N. E. of Dingle, there is a remarkable precipice, above 100 feet high, called Foylenagreave, immediately west of Lough Slat, in which the conglomerate, above 60 feet thick, dips N. W. 25, overlying a brown, micaceous, flaggy grit rock, which dips N. W. 60°. This is a very wild, romantic spot, and though I did not examine the country westward of Lough Slat, I believe this conglomerate exists over a large area in this locality, not yet known, which would be well worthy the attention of a geologist.

7. The Hill of Doon, half a mile S. E. of Lough Slat, and four miles N. of Aunascall, has a cap of conglomerate a quarter of a mile in diameter, dipping N. about 30°, and lying on thick, strong, green grit beds, which are visible in the next stream eastwards, where they dip W. 60°.

8. On Cummeenhill, about a mile east of Doon, is another patch of the same rock, dipping the same way, and lying on green grits and slates, which have a dip of 60° W. This is well exposed in a high cliff, west of Loughacummeen. I believe this conglomerate exists eastwards, on the summit of the hills in the townlands of Maghasheela and Glanlough North, but did not examine the ground.

Here I may observe, that in Munster the Carboniferous formation exists to a great thickness between Tralee Bay and the Galtee

Mountains; but in the western part of this peninsula, it appears to have been nearly all carried away by denudation, leaving, as a memorial of its former existence, only the eight small patches I have just described, of its very lowest beds. Different from these, however, is the case that follows.

9. At Scrallaghbeg, farther eastward, another junction of conglomerate, overlying green grit unconformably, occurs. This is a few perches south of a sharp turn in the public road, seven miles N. E. of Aunascall, and ten miles from Tralee. The Old Red Sandstone at this place, is evidently of the lower beds, and a continuation of the several patches, Nos. 6, 7, 8, being in the same line, country, and having a similar dip. From this place it proceeds eastward, covering the northern slope of the hill for about three miles, where it turns southward to Bartregoum, the highest point of Slievemish Mountain. From this summit eastward, the whole mountain is covered with it sloping downwards gradually to the east for twelve miles, without much increase in thickness, till it comes near the coach-road from Tralee to Killarney, at Currens, where it is succeeded conformably by calcareous slate, containing a profusion of the ordinary fossils of the Carboniferous Limestone, and one of the best localities in Ireland for those fossils. This slate is again covered by the limestone about Castle Island, and that surmounted by millstone grit, the base of the coal rocks of the Slieve Luaghar Mountains.

Thus, this conglomerate of the Old Red Sandstone can be traced through the Dingle peninsula, in eight detached patches, from Sybil Head to the summit of Slievemish Mountain, and the overlying Red and Yellow Sandstone eastward along that mountain passes into the calcareous slate, limestone, and millstone grit of the great Munster coal district.

The section from Brandon Head to Bull's Head is the longest across the strike of the strata in this peninsula, and is instructive. At Brandon Head, on the north, the brownstone dips to the south, at an angle of about 70°. At Connor Hill, in the middle the rock is green and gray grit, and also dips south at about 60°. At Bull's Head, on the south shore, brownstone, associated with gray slate, dips southward at an angle of about 80°. In this line, from Brandon Head to Bull's Head, no fault has yet been detected, no protrusion of greenstone or other igneous substance; nothing apparent, that would disturb a regular succession of the rocks. There is even an inference, that there is no doubling up or repetition of the strata, in the fact, that the fossiliferous band at Ferriter's Cove, composed as it is of greenish and gray slaty rocks, with abundance of *Catenipora escharoides*, is by its strike in the lower part of this section, and the fossiliferous band at Foyleathurrig, which has neither green nor gray slates, nor *Catenipora escharoides*, but brown slates and grits, and other species of fossils, is evidently in the upper part. Those two bands are not the two arms of a convolution; but one band near the base, and another near the top of a continuous unbroken section, which here is twelve miles from north to south, with an average dip of 70°, making a thickness of 59,500 feet, without seeing either the bottom or the top of the group. By the fossils alone, without reference to the thickness, this group, which consists of alternating bands of brownstone, and brown, red, and purple slates, green and gray grits, and green and gray slates, is all Silurian, without any doubt: and the overlying sandstone, with its band of conglomerate for a base, and its unconformable position, is the true Old Red Sandstone of the Carboniferous system, which, as was said before, passes in parallel beds and conformable succession, upwards into the mountain limestone.

Besides the Dingle peninsula, there are other brownstone districts in Ireland, some of which are intimately associated with strata containing Silurian fossils. I shall notice them separately, beginning in the north of Ireland, and proceeding southward as they occur upon the map.

1. The first is a region in the counties of Tyrone and Fermanagh, stretching in a south-west direction, between Pomeroy and Enniskillen. It is forty miles long, and nearly ten broad. It is intersected by many dykes of greenstone, and has numerous bosses of brown porphyry. The brownstone of this district consists of the following varieties:—First. A strong brown conglomerate, composed chiefly of pebbles of brown quartz rock, hard and semi-transparent at Lisnanick, on the north-west corner. Second. The chief part is composed of brown grit, near the south-east border. Third. Some softer slates and shales, apparently in the upper part, about Fintona and Trillick. A remarkable characteristic point in the grit beds here and elsewhere is, that they contain angular fragments of brown slate, of very fine grain, two to four inches long.

At the north-east end, near Pomeroy, the Silurian gray grits and slates are surmounted by brownstone. Although no actual contact is got of the two rocks, yet a comparison being made of the dips, where the two are found nearest to each other, leads to the conclusion that they are conformable. Near the south-west angle of this region, at Lisbellaw, the fossiliferous Silurian gray grits and slates are covered by the brownstone conformably, both having the same strike and dip at their junction. The thickness of the brownstone is pretty well seen in the middle of the district, in the line of country between Clogher and Fintona. Proceeding along the road, about a mile from Clogher, it dips north-west, at an average angle of about 40°, and this is observed here and there for about two miles, and perhaps farther, for the country becomes covered with drift. With such dip, two miles of a country would give a thickness of 6780, or say 7000, feet. In the brownstone strata of the district, no fossils have been discovered; the examination made having been hasty and superficial. There are some beds of red limestone in the vicinity of Nine-mile House, on the north-east quarter, which are worthy of a closer search.

In the Tyrone district, along the south-east border, the brownstone lies below the Old Red Sandstone unconformably. It dips generally to the north-west, while the Old Red Sandstone, of which the lower part is red, and the upper part yellow, has a contrary dip, being to the south-east. This might be considered the top of an anticlinal line, the rock being sandstone at both sides; but it is not so. The brownstone, as just stated, is of great thickness, composed of brown grits, very hard, and dipping north-west 40°; while on the south-east of this, the band of sandstone is red near base, yellow near the top, all very soft, with some beds of black calcareous slate interstratified, and is immediately succeeded by carboniferous limestone. The whole band of sandstone being thin, and dipping at a low angle, shows that it is not a counterpart of the hard, brown, thick-bedded group, just described, and, therefore, not an anticlinal line.

2. The second brownstone district is that of the Curlew Mountains, in the northern part of Roscommon, and extending westwards into Mayo—a narrow band of about thirty miles long, by five or six miles wide. At the east end, near Keadue, green grits and slates occur; and at Uggool, at the other end, five miles north-west of Ballaghaderreen, gray grits, limestones, and slates occur, abound-

ing in Silurian fossils; but the relation of these with the brownstone strata cannot be determined, as there are numerous protrusions of porphyritic rocks, which interrupt the succession. Similarly with the Tyrone district, the Old Red Sandstone and limestone at Boyle, and at Ballaghaderreen, lie unconformably on the brownstone, along its southern border.

3. About Castlebar, ordinary Old Red Sandstone is abundant. So far as physical aspect goes—that is, brown colour and excessive hardness—there is a district north-west of this town, lying between Lough Conn and Newport, which I would put in the brownstone division. I have not had opportunity, however, to work up this district, either for succession or fossils, by any more than a slight examination. A small district of similar character occurs on the south side of Clew Bay, and west of Louisburg.

4. The Killery Harbour district comes next. It is situated in the county of Galway. On the road from Clifden to Westport, at Blackwater Bridge, three miles south of Killery Harbour, a succession of strong conglomerates, gray grits, and gray slates, containing an abundance of Silurian fossils, lie unconformably upon strata composed of mica slate, with alternating groups of gray crystalline limestone and quartz rock, all without fossils; and, what is remarkable here is, that, in general, a band of brownstone forms the base of the Silurian district. This band varies from 200 to 300 feet in thickness and is surmounted by gray and green grits, and slates, which abound in Silurian fossils, with accompanying bands of coarse conglomerates. The district extends, on the south side of Killery Harbour from the ocean eastwards, in irregular form, to Lough Mask and Lough Corrib, and in all the middle and eastern parts the brownstone band forms a conspicuous base, and generally an index to any locality where fossils may be expected, as the fossiliferous beds overlie it immediately. I may add that, in this district, as well as at Dingle, there is an enormous thickness of green and gray grits and slates, amounting to many thousand feet, over the principal fossiliferous band near Blackwater Bridge just alluded to. The beds of rock in general dip and accumulate from this locality to the north-east towards Toormakeady, on the west side of Lough Mask; and then, as if to tie all this mass of strata into one great parcel, a thin band of limestone occurs, near the top at Glensaul, in which Silurian fossils have been found,—this being a parallel case with the Brandon Head section, already described.

5. The next in order is the Dingle district, into which I have entered already; and will only repeat that the band of brownstone at Sybil Head, below the fossils, is 3600 feet in thickness, not including the bottom beds, which are under the sea; and that between Clogher and Fintona, in the county of Tyrone, the brownstone rock is at least 7000 feet thick, without the lower beds also, which are not visible there.

Those numbers go pretty far as an approximation to the thickness of the Old Red Sandstone of Scotland and England, with, however, the important difference, that the British rocks are considered as Old Red Sandstone. The Irish equivalents—if equivalents they be—are undoubtedly Silurian.

In the south of Ireland there are also other tracts of brownstone, besides that in the vicinity of Dingle. They occur in some of the highest mountains in the country; for instance, Macgillicuddy's Reeks, Torc, Mangerton, the Priest's Leap, and other mountains in Kerry. In Cork are the Paps, the Boggra Mountains, Mount Hilary, Knockoura, and so on to the Knockmeldown and Cummeragh Mountains, in Tipperary and Waterford.

The two localities, Dingle and Killery Harbour, are 200 miles asunder; and yet hand specimens of slate or grit, or specimens in the rock, abound in both, which for hardness, grain, or colour, could not be known asunder; and I may include with those, as having the same lithological character, Macgillicuddy's Reeks, and the other mountains of Kerry, Cork, and Waterford, already enumerated. In those lofty ranges, the association of the brownstone with green and gray grits, and gray, red, and purple slates, is of frequent occurrence, and requires some notice. In the grit beds, though they compose the chief volume of the mountain masses, no fossils have yet been discovered.

Since fossils have become indicative of the age of groups of rocks, attention appears to have been drawn away from their lithological character. This, however, is not to be rejected; and it is particularly useful where no fossils are found. It is not easy to give a description in writing of a rock specimen, so as to be generally understood; but I may say, that I would know even a hand specimen of the green grit of the Killarney Mountains, or the brownstone of Sybil Head, if I saw them or their equivalents at Londonderry, or anywhere else; and I think an experienced eye will be seldom wrong in recognising a group of rocks from their stony characters.

I have already described the Brandon Head section, and shown it to be Silurian; and I consider, as I have just said, the rocks of that section to be identical, in external character, with the rocks of many of the mountain ranges of Kerry, Cork, and Waterford; but, to show some of my reasons for so thinking more fully, I must go a little into detail. Alternations similar in character and colour with those in the Brandon Head section are observed about Derrycunnihy, near the tunnel, on the road from Killarney to Kenmare, where bands of rock, brown and green, are crossed in travelling. So it is in the Boggra Mountains; a section occurs in the Fermoyle river, on the roadside from Kanturk to Cork, where alternate bands of green and brown grits and slates are found in succession.

The cuttings in the railway from Mallow to Cork give a similar result, on the great scale; and on a smaller, I found the following succession in a piece of cutting, in the townland of Carrigduff, three miles south of Mallow, where every man may study it for himself. Beginning at the bridge, which is on the southern boundary of the townland, it is as follows, proceeding northwards:—

From the bridge to entering the cutting, ...	40	yards.
Brown slate, ...	15	"
Green flaggy grit, ...	1	"
Brown, ...	5	"
Green, ...	5	"
Brown, ...	3	"
Green, ...	1	"
Brown, ...	1	"
Green, ...	8	"
Pass 147½ miles post.		
Brown, with green spots, ...	19	"
Green, ...	8	"
Brown, ...	4	"
Green, ...	4	"
Brown, ...	3	"
Green, ...	4	"
Brown slate, ...	6	"

At this place a fault occurs, having brown slate on the south side, and green grit on the north.

Green grit,	3	yards.
Brown,	6	„
Green,	8	„
Brown,	5	„
Green grit,	5	„
Brown,	4	„
Green thick beds of grit,	5	„
Brown,	9	„
Green, gray, and brown, confused,	2	„
Brown,	8	„
Green,	9	„
Brown slate, including three yards of brown grit,	26	„
Green,	14	„
Brown,	25	„
Green,	1	„
Brown,	1	„
Green,	13	„
Brown,	21	„
Green,	11	„
Brown,	1	„
Green,	1	„
Brown,	3	„
Green,	3	„
Brown rock ends,	71	„

Cutting ends at 400 yards from the bridge.

Thus we find in this section of 360 yards in length, twenty bands of brown grits and slates, and nineteen bands of gray and green colour alternating with them; so that the colour of those gray, green, and brown grits and slates goes for nothing as an argument to prove the age of the rock.

Many other sections interesting on this part of the subject occur in the country. There is one in a quarry at Commons, half a mile north of Cork, on the Blarney roadside, worthy of a visit, and a fine section in the railway cutting at Rathpeacon, two miles north of Cork, in which the alternation of green and brown colours are visible, as well as occasional examples of a bed, or a band of rocks, being of the one colour near the surface, and passing into the other below, where the strata stand nearly on edge.

Regarding the section just described at Carrickduff, and the whole group of ten or twelve miles of the same kinds of rock from that to Cork, it may be argued that as no fossils have been found in them, their geological position is doubtful, and they may belong to any formation; but though the proof by fossils has not yet been made out here, as it is seen in the Dingle peninsula, yet a part of the proof which is observable in the western district occurs here also; that is, the unconformability between the beds of the Carboniferous formation, and the underlying green and brown grits. At Quartertown Upper, one mile and a half south of the town of Mallow, in the railway cutting, the brownstone rock is seen in gentle undulations, having a low general dip eastwards, and noticed at the junction No. 67 in the Table; and the Old Red Sandstone at this place lies on it unconformably, having a dip northwards towards Mallow, where it is soon covered by the mountain limestone and coal rocks in the vicinity of that town.

At the time the formation of the railway was in operation, this junction was pretty well exposed, but at present it is not so; the dressing of the slopes obscured it, but still the hard brown grit may be seen south of the junction, and the soft red and yellow sandstones north of it. I may observe of the locality that there was a stream of water which came in from the east, conveyed in a small trough over the railway, exactly at this junction. The unconformability here I take as conclusive that the rocks on both sides of the junction, that is, the limestone at Mallow, and the brown grits at Quartertown, belong to two different geological epochs.

In this place I will say a few words on the Yellow Sandstone of the south. I have already stated that in the Old Red, in the north of Ireland, the prevailing colour is red, and the volume thick. In the south the yellow colour predominates, and the volume is much diminished. At Muckross, near Killarney, and at Quartertown, near Mallow, it appears to have dwindled to a very thin band, but still true to the type. The rock is soft sandstone, and not hard grit. To the south of these two last-mentioned places I do not know of its existence anywhere in Kerry or Cork,—keeping in view the type, as seen near Hook Head, or anywhere northward, in Clare, Galway, or Tipperary, Tyrone, or Down.

I know that the remains of plants are got at Cork, in one bed of a grayish-white sandstone, which bed, two or three feet thick, I believe is in the brownstone strata; and I have seen plant remains in a similar bed, and in a similar geological position, at Knockahavaun, two miles N. E. of Dungarvan. We had also some of the same kinds exhibited here last year, by Dr. Griffith, from Tallow Bridge, to illustrate his paper on the Yellow Sandstone, which the Society may remember; but neither the sandstone nor the plants are like those that occur in the Carboniferous rocks,—the Lepidodendrons and Calamites being of a stunted growth, and different species. Professor Rogers produced specimens of plant remains at the last meeting of the British Association, at Glasgow, identical with those got at Tallow Bridge; and he put them forward as having been found in some of the Silurian rocks of America, and exhibited them as geological curiosities, plants of Silurian age.

I have thus endeavoured to show, that in our Irish Palæozoic rocks there are two old sandstones which belong to two distinct eras in the history of the earth,—the first, being the lower and the older, is of a brown or reddish-brown colour, and is composed both of grits and slates, the grits very hard, and the slates having a strong cleavage. Moreover, that in the south and west of Ireland, where those rocks are pretty fully developed, the brown and red grits and slates alternate with green and gray grits and slates of the same age; that in Kerry, those rocks amount in one section to above eleven miles in direct thickness, without the upper or lower beds, which are invisible; that they include bands teeming with fossils of the Silurian age, and that the beds usually dip at a very steep angle, except in the tops or bottoms of some of the great convolutions which occur occasionally in parts of the country;—that the second or upper part of those sandstones is that band which forms the base of the Carboniferous rocks; it is more red, more soft, and thinner, its average thickness being about one thousand feet. It contains no green or gray grits or slates, and very seldom exhibits cleavage in its shales, only lines of lamination: the beds generally lie flat, or nearly so, and these are features affording some points of contrast when compared with the older rocks.

The Devonian rocks are said to constitute a passage, or gradual change, from the Silurian into the Carboniferous formation, and to partake of the nature of both, in fossils, as well as in rocks. I have given a list of seventy-eight localities, any of which may be visited —and stated that I know many more where the Old Red Sandstone lies unconformably on the inferior rocks, and not one case do I know in Ireland where they are conformable. The base of the Old Red, therefore, forms an abrupt, distinct boundary line between the two. All the rocks in the vicinity of this line are resolvable into either the group above it, or the rocks below. I hope, therefore, I have made clear the conviction that is on my own mind, that there is no passage, or gradual change, between the lower and the upper system, and consequently no Devonian rocks in Ireland. I know that the reverse of this statement has been put forward years ago in this Society, and reiterated many times since. Even last year a paper was read here, stating that the brown grits of Dingle are Devonian; but I look upon this as without foundation. Any grits, or slates, that lie between two bands of Silurian fossils, the whole being conformable, should be classed with Silurian rocks, as well as the sandstones and shales lying between two beds of coal, should be put into the coal series.

Indeed, it appears quite impossible to reconcile the Devonian system, as tabulated by Sir Charles Lyell, at p. 365 of his Manual, with the appearances presented in Ireland, and no doubt this is the best authority now extant. In this work the Carboniferous formation consists of only two members,—the coal series, and the mountain limestone. The Old Red Sandstone, which forms a natural division of the formation, is cut away, and classed with lower rocks, thus:—

Upper Devonian.

a. Yellow sandstone of Dura Denn, Fife.
b. Red sandstone and marl, with cornstone of Herefordshire and Forfarshire.
Paving and roofing stone, Forfarshire.
Upper part of Devonian beds of South Devon.

Lower Devonian.

Gray sandstone, with Ichthyolites, Caithness, Cromarty, and Orkney; lower part of Devonian beds of South Devon, and green chloritic slates of Cornwall; limestone of Gerolstein, Eifel.

Under these are the Silurian rocks, comprising the tilestone of Brecon, the Ludlow and Wenlock limestones and shales, the Caradoc sandstone, and Llandeilo flags.

The first member of the system, the yellow sandstone of Dura Denn, is the equivalent of the Irish Old Red, or, at least, of the upper part of it. It appears to me that this ought not to be separated from the Carboniferous formation; the three subdivisions of which, as already enumerated, from the general parallelism of their beds, were undoubtedly deposited in one geological era, and a comparatively calm one it was. Abundant proofs exist of tremendous disturbances previously in the upturned edges of all the lower rocks, and subsequently int he contortions of the strata of the formation itself, where they are not broken up by faults; for, even in those contortions, the beds of sandstone, limestone, shale, and coal, are alway parallel to each other through every undulation and inclination. Besides this, certain fossils are common to the whole three subdivisions. I saw in Professor Haughton's cabinet, in Trinity College, some specimens procured from the yellow sandstone, or upper part of the Old Red, at Porter's-gate, near Hook Head, in Wexford. Among them were *Orthis crenistria*, *Atrypa pleurodon*, *Producta caperata*, *Producta concinna*, *Producta setosa*, *Sanguinolites sulcatus*, *Lithodomus dactyloides*, and others, all mountain limestone fossils. Again, in the county of Tyrone, in the river near Cookstown, and about twenty chains below Kildress Bridge, specimens were obtained by Colonel Portlock, from Red Sandstone. The bed which contains them is near the base of the Old Red in that locality. Those specimens are in the collection of the Geological Survey, in the Museum of Irish Industry, Stephen's-green. They are very fossiliferous; and among them are found *Producta Martini*, *Producta setosa*, *Orthis umbraculum*, *Orthis crenistria*, *Atrypa pleurodon*, and others; all common in the mountain limestone.

Neither are the coal rocks without similar fossils. At Carrownanalt, two miles N. E. of Keadue, I found in a ravine in the coal-measures thirty-five species of shells and Trilobites, in a few blackish calcareous beds, altogether about three feet thick. This fossiliferous band is about 200 feet over a bed of coal, which has been worked in the vicinity. Of the thirty-five species, twenty-six occur in the mountain limestone, and are, therefore, common to both.

This double link, the parallelism of the beds, and the community of the fossils, is against the Old Red being separated from the Carboniferous rocks, and joined to other inferior rocks, with which, in Ireland at least, they have no relation but contact.

In the lower Devonian, as given in the Table, the gray sandstones of Caithness, and the green chloritic schists of Cornwall, are of a colour and kind that I never saw in the Old Red Sandstone of Ireland.

It is much to be regretted that Sir C. Lyell has not supplied even an ideal cut to show how he joins the Old Red Sandstone to the underlying rocks. Such a cut would show something relating to the conformability of the groups, which the verbal Table does not express.

In the diagram, which I exhibit, let the upper part with horizontal strata represent the Carboniferous formation, with its three subdivisions—coal, limestone, and red sandstone; and let AB be the base of the latter, the conglomerate bed, laid unconformably on the inclined ends of the underlying strata, as a foundation. Those strata, as I have shown, are of many kinds. In the seventy-eight localities I have pointed out, the conglomerate lies on fourteen different kinds of older rocks. Let *a* represent granite; *b*, stratified quartz rock; *c*, mica slate; *d*, primary crystalline limestone; *e*, greenstone; *f*, amorphous quartz rock; *g*, gray clay slate; *h*, gray grit; *i*, red clay slate; *k*, green grit; *l*, green chloritic slate; *m*, brownstone.

Now cut away the Old Red Sandstone from the Carboniferous formation, and let it go to the underlying rocks; then take of these rocks a horizontal band 1000 feet in thickness, to represent the remainder of the Devonian. It is plain, then, that in Ireland this formation will be represented by its upper part, the Old Red; and below, by portions of all those other older rocks; and, therefore, that all the older stratified rocks in Ireland take a share in the Devonian system, as well as some of the igneous.

This is my view of the Devonian system. Had it been composed of a regular succession of rocks, lying together like the Silurian system, or like the Carboniferous formation, there would be no doubt about it; but to make it good, instead of working it out in Devon, its own country, one of the most profound geologists found it necessary to ransack Europe, to get suitable parts to make it up; and it appears to me that Sir Charles Lyell undertook no easy task when he took a limb from Dura Denn, a joint from the cornstones of Herefordshire, an arm from the green chloritic slates of Cornwall, a leg from the gray sandstones of Cromarty, and a part from the Eifel limestone; and endeavoured to join those distant fragments together, and make out of them a consistent whole.

At the meeting of the British Association at Glasgow, last September, in one of the geological discussions, Professor Sedgwick said that the Devonian has no base. In this assertion, I believe, he cannot be contradicted. No estimate has ever been attempted to be made of its thickness,—nor ever can be, as it appears to me.

I would not have thought it necessary to notice the brownstone as I have done in this Paper, any more than the green and gray rocks with which it is associated, only for the circumstance, that it appears to have been mistaken for the Old Red Sandstone of the Carboniferous system,—there having been no distinction drawn between them; and that a considerable amount of confusion has crept into the classification of rocks, in consequence of this mistake. I have taken pains to describe both kinds, and to point out the difference between them; and I hope my observations may be useful to others who may have better opportunities of prosecuting the inquiry, with a view to settle this important question.

OBSERVATION ON SOME OF THE JUNCTIONS ENUMERATED IN THE TABLE OF LOCALITIES.

1. The junction at Conaghra, five miles W. of Ballycastle, in Mayo. Though the dip of the stratified quartz rock on the coast here, and the dip of the Old Red Sandstone, are both eastward, and not far from the same angle; yet, on close inspection, it will be observed that the lowest bed of sandstone covers over the ends of several beds of the quartz rock; and, as it proceeds south, mounts over the mica slate also, which there overlies the quartz rock beds conformably.

2. Near Bangor, on the road side, there is a good section of the Old Red Sandstone, showing its whole thickness at that place, and the transition into the black slates and thin limestones which lie over it here, and which abound in mud fossils, Nuculæ, Modiolæ, &c.

6. At Ballaghaderreen, the rock which underlies the sandstone is a brown slaty porphyry, which shows traces of a dip to the north. This porphyry fills a flat district four or five miles to the N. W., where it is succeeded by the Silurian fossiliferous slates of Uggool.

12. At Drung the Old Red Sandstone runs out at the shore to low water.

17. At Seegronan the inferior rocks abound with bands of crystalline limestone, interstratified with mica slate. The marble is striped, white and gray mixed; and some of it a beautiful salmon colour.

21. A good section of the Old Red Sandstone is visible in the river running through Kildress, from Orritor to Cookstown. Peculiar fossils are got in a bed of Red Sandstone near the base of it. *Atrypa sublobata*, and two or three other small shells, occur in it. A band of red limestone, accompanied with red shale, is seen in the river bank, which has been quarried for use, and contains some of the usual fossils of the limestone.

22. At Latbeg, near Clogher, in ascending the high ground northwards, the beds of brownstone dip to the N. W., at an angle of 40° to 50°, and accumulate in that direction for about two miles, showing a great thickness of this brown grit. The rock in the valley dips at a lower angle, in an opposite direction; and, as both are sandstones, the anticlinal might be supposed the top of a convolution; but this is not the case, as, if so, the rock dipping to the south would be brownstone, the same in lithological character as that which dips N. W., which it is not. It is a whitish or yellowish thin bedded flag, with alternations of black shale.

23. The Old Red Sandstone at Gortnagross, near Cushendall, lies on mica slate, and its lower conglomerates are formed of rounded pebbles and fragments from that rock,—with little else.

27. At Drummanbeg, three miles N. N. E. of the town of Armagh, in the large quarry whence was got sandstone to repair the church, I got a fish-tooth, which resembled a Plectrodus, but was much larger than those figured in the Silurian system, being above half an inch in length.

30. The Red Sandstone at Kilcurry seems but thin, as the limestone appears not far from its base; but situated as it is, in the vicinity of metamorphic and porphyritic rocks, there may be a fault, in which part of the sandstone is buried.

33. The strong green grit is well seen at Drumany, near Killeshandra. On the road side the nearest sandstone lies N. W., nearly half a mile off in the flat land of Portlongfield, and lies nearly level; it is of a yellowish-white colour, and contains a few large rounded quartz pebbles.

35. At Portrane Pier there is only a small part, about five yards

long, of one bed of coarse red conglomerate, visible over the gravel on the shore. It rests on the Pier, which is greenstone, with veins of calcareous spar. Immediately south of this a black shale occurs, with rounded masses of gray limestone, and in one of those nodules the *Orthis reversa* was got, which Mr. Salter described and figured for Mr. Griffith's Synopsis of the Silurian fossils. Greenstone, as here, often makes its appearance in the boundary between the Silurian and Carboniferous systems.

38. At Grangeclare the Old Red Sandstone is but a small patch lying on the south flank of the Dunmurry range of clay slate hills, which are probably Silurian, from the proximity of the Chair of Kildare, a hill of light gray limestone, with some associated black and red slate, abounding in Silurian fossils.

43. At Cornagha, near Boyle, and along the south flank of the Curlew Mountains, the brownstone dips north, at a low angle, about 10°. At Ballinphuil the yellow part of the Old Red Sandstone is visible, and dips S. 7°. These two observations are farther asunder than I would be inclined to adopt, were it not that both rocks are remarkably steady and regular in the dip for a good space around; as at No. 22, both rocks being sandstone, this difference of dip might be considered a slight anticlinal axis in the one system; but the arm to the north is a hard brown quartzose grit, remarkably uniform in physical appearance, and the beds accumulate to a large amount, while that to the south is a soft whitish sandstone, at Termon immediately surmounted by limestone, showing that the two sides of the axis belong to two different systems.

45. At Derrylaura, near Oughterard, the underlying rock is granite, which here shows itself between the Old Red Sandstone and a Silurian dark gray slaty grit, very fossiliferous.

46. At Cregganore, near Loughrea, the base of the Old Red Sandstone is seen in one of the clearest junctions in Ireland. Here are several patches of the lowest bed of the conglomerate, seen lying horizontally on the black slate, which dips at a steep angle. The calcareous slate, which lies over it, is visible also in a stream a little below on the side of the hill, thus showing the whole thickness of the sandstone, which here is unusually small. This locality is known for miles around by the name of Toberelathan, or St. Elathan's Well.

62. At Kinard, near Dingle, on the hill, level beds of soft Red Sandstone lie on the edges of vertical beds of brown hard grit, in

which some beds of purple slate are interstratified; and this slate contains Silurian fossils. They are got in the cliffs on the shore, in some accessible spots; and about high-water mark, some beds of reddish limestone show marks of them also. In the Red Sandstone, on the top of the hill, is a remarkable mass of white quartz, forming a crest, which at a distance resembles an old castle.

63. At Glenteenassig, in the Dingle district also, immediately west of Loughnascall, is a magnificent exhibition of the lower conglomerate, in a precipice above 100 feet high, lying on the upturned edges of the beds of a brown micaceous flaggy grit, belonging to the lower formation, as at Kinard. The conglomerate here is about 80 feet thick. The strike of the two rocks is nearly the same; but the lower dips N. W., at an angle of 65°, while the upper dips at an angle of 25°. To the geological tourist this place is well worth a visit.

64. Doon Hill, near the latter locality, has a cap of conglomerate dipping N. W. about 30°. The junction with the underlying rock is not visible. The nearest part of it to the place is seen in stream a little eastward, where very thick beds of a chloritic greenish gray grit rock are visible, dipping W. at an angle of 65°.

67. At Quartertown upper, near Mallow, there is a junction of the brownstone and Old Red Sandstone. It was exposed when the railroad was in progress of being made; but since has been much obscured by what the engineers call "soiling the slopes." The brownstone south of this junction presents the usual physical aspect it does in the south of Ireland, hard and strong-bedded, the beds a little undulating, with an average dip S. E. The Old Red, which dips N. E., or towards Mallow, at about 20°, consists of a soft red rock below, succeeded by a little bluish gray shale containing *Modiola cypricardia*, &c., and over this a yellow sandstone which disappears northward under the drift.

68. At Waterford, and its vicinity, the lower beds of the Old Red Sandstone are well exposed on the hill at Newrath, as well as on the west side of the river, opposite the railway station. The unconformability here is very clear. Proceeding northwards from this place by Mullinavat, the conglomerate is succeeded by red beds, which, towards Thomastown in the upper part, as usual, are yellow, and covered there by the limestone of Kilkenny. At Kiltorkan, near Ballyhale in this line, are a few beds of very fine-grained yellow rock,

in which remains of plants and shells have been discovered and made known by the persons employed on the Geological Survey.

72. At Rocksborough, near Wexford, the lower beds of conglomerate were visible at a farm-house on the roadside; but recently a new road has been made close by the house, and the rock thereby concealed, or quarried away. It lies here on yellow massive quartz rock, which has obscure joints of cleavage, or of bedding, dipping towards the north-west; the lines are nearly obliterated.

77. At Templetown, on the shore, is a clear, well-exposed section of the Old Red Sandstone, lying on gray slate, which, from the junction towards Duncannon, is very much contorted. The sandstone here has a pretty regular dip southward, averaging about 12°. Near its southern termination in a little bay are thin beds of limestone, with black shale, and full of fossils; and over this again a thin band of yellow sandstone. Then come the shales and limestone, which continue to Hook Head. This I consider one of the most complete typical sections, and the best exposed in Ireland, of the Old Red Sandstone and limestone.

THE Society met on the 14th of May, 1856, on which occasion the following Paper was read.

ON THE LOWER CARBONIFEROUS BEDS OF THE PENINSULA OF HOOK, COUNTY OF WEXFORD. BY THE REV. SAMUEL HAUGHTON, M. A., PROFESSOR OF GEOLOGY IN THE UNIVERSITY OF DUBLIN.

THE parish of Hook, county of Wexford, is well known to afford one of the best sections of the lower Carboniferous beds in the south of Ireland; and as no detailed account of it has been published, I have put my notes together, and endeavoured to lay them in a connected form before the Society. From the fact of the strike of the beds running across the peninsula, an opportunity is afforded of studying them at both sides, in the Waterford Harbour and on the sea-side; and it is not difficult to obtain an approximate value of the thickness of each deposit.

There is an uninterrupted series of conformable deposits, extending from the Old Red Sandstone conglomerate on the north, to the Carboniferous Limestone of Hook Light-house on the south, unbroken, save by a few unimportant faults, which do not prevent a correct estimate being formed of the thickness of the entire series. The beds are conformable throughout, and admit of being divided into five distinct groups, which I propose to describe in succession, commencing with the oldest beds of red conglomerate, which rest on the Silurian slates unconformably.

1. OLD RED SANDSTONE AND CONGLOMERATE.

The Old Red Sandstone and conglomerate of this district rest unconformably on the nearly vertical beds of Silurian slates, the line of junction extending in nearly a straight line from Carnivan Head on the east, to a point half-way between Harryloch and Templetown church on the west. The nature of the junction between the conglomerate and slate is well shown in the face of the cliff at Carnivan Head.

The beds of slate are nearly vertical, and the Red Sandstone and conglomerate beds are inclined at an angle of 10° to the horizon. I propose to place, provisionally, the uppermost limit of these beds at a line drawn from the rocks north of Sandeel Bay on the east, to the boundary of the townlands of Templetown and Houseland on the harbour, or west side. My reasons for fixing on this boundary will be explained in the next section. Within the limits I have assigned, the rocks consist of slightly inclined beds of massive red conglomerate, alternating with layers of red sandstone and red shale. They are quite destitute of fossils; and may be considered as typical beds of the Old Red Sandstone of the south-east of Ireland. I have measured the thickness of these beds in a variety of ways, and estimate it at 1150 feet. The sea must have been shallow during the deposition of these beds, as it is not possible to conceive any action save that of coast waves capable of forming such masses of rolled shingle, alternating as it does with sands and mud, tinged with peroxide of iron, evidently introduced by currents of a less violent character than those which laid down the rolled shingle of the sea beaches, which formed the materials out of which the red sandstone conglomerate was elaborated.

2. PLANT BEDS.

The uppermost portion of the sandstones and conglomerates consists of alternating beds of red conglomerate, red micaceous sandstones, and coarse red shale, succeeded conformably by gray micaceous sandstones, gray conglomerate, and dark gray shale, with yellow and white sandstones alternating with reddish argillaceous sandstones,—the entire series being characterized by the presence of imperfectly preserved remains of plants, which invariably occur in the gray and white micaceous layers of sandstone, and never in the red sandstone and shales which alternate with them. In one locality on the western side, these remains become so numerous as to constitute thin seams of anthracite, from one to two inches in thickness. The fossil plants, although very imperfectly preserved, present a general resemblance to the forms of fossil plants found at Tallowbridge, in beds of similar age, some of which were figured by me in my account of the fossil plants of the lower Carboniferous period. Some of the most common of the Hook plants are figured in the annexed Plates.

Figure 1 represents the imperfectly preserved exterior of *Knorria dichotoma*, in which the spiral arrangement of the leaflets is traceable, although almost obliterated.

Figures 2 and 4 represent natural casts of the interior of the same plant; and figure 3, a cross section of same, showing the existence of a central axis, as in *Stigmaria*. The central axis was connected with the outer stem by a remarkable series of spirally arranged woody spiculæ, which are shown in figures 2 and 4.

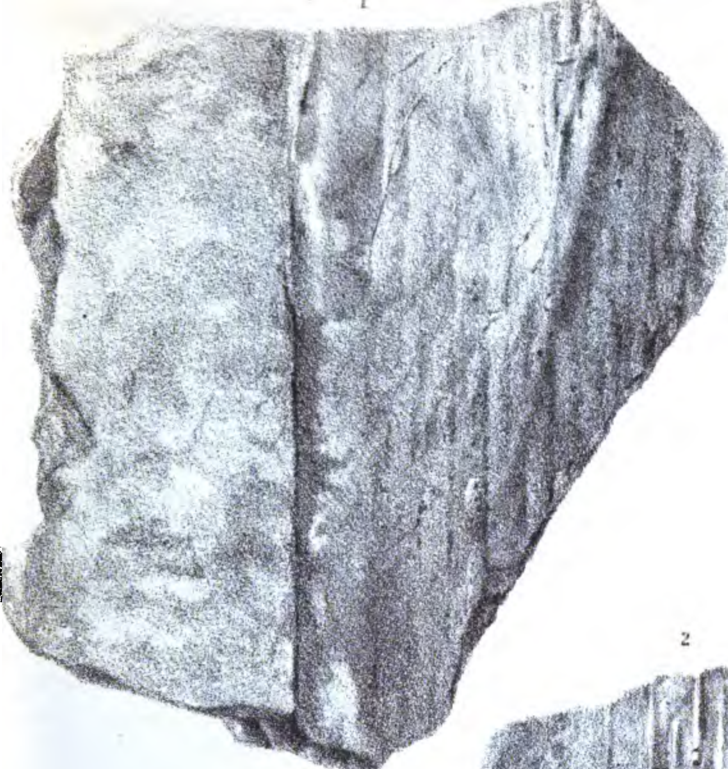
Figures 5 and 6 show smaller branches of the same plant; in these, however, the spiral arrangement of the leaflets is not visible; and it is possible they may be the remains of a distinct form.

The total thickness of these plant beds is 382 feet. The gray and yellow sandstones which contain the plant remains were evidently brought from a quarter different from that which supplied the red sandstones and occasional conglomerate beds which are found with the plant beds. We may suppose these vegetable remains to have been brought from a distance, and deposited with the red sandstones in a sea which was probably growing deeper, and which ultimately became the receptacle of exclusively marine remains.

3. OLDER LIMESTONE.

We find the plant sandstones just described succeeded by a thick series (851 feet) of alternating beds of arenaceous limestone, black

1



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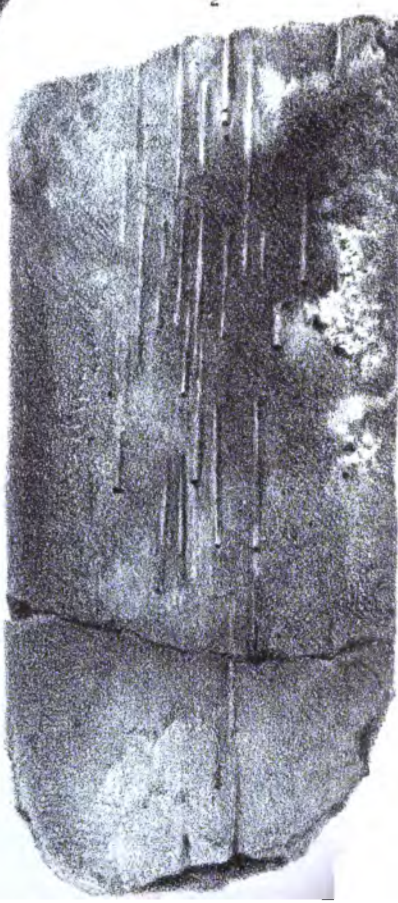

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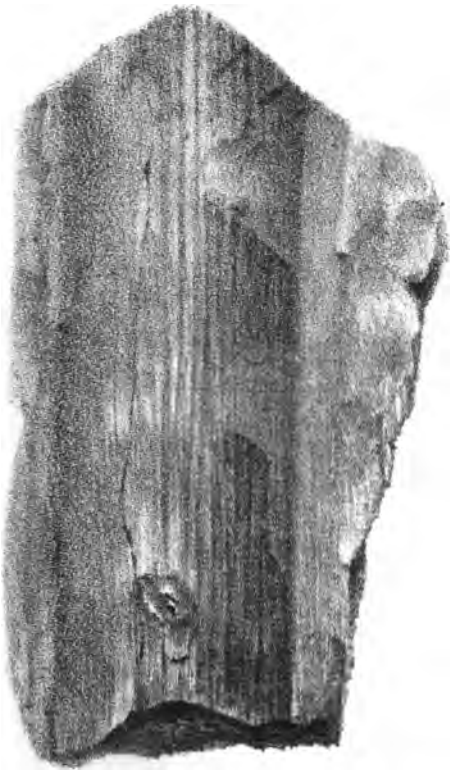

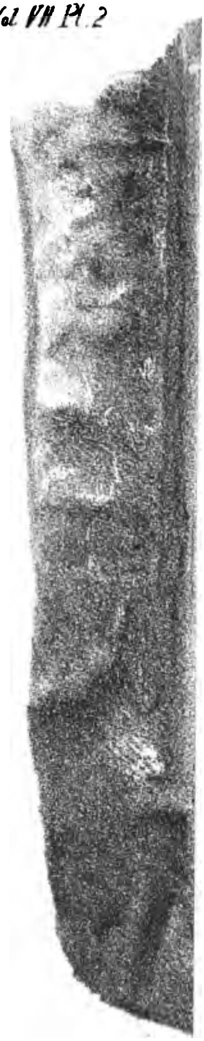

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8

shale and sandstone, with red ochreous limestone, followed by flaggy limestones, sufficiently pure to be used for agricultural purposes.

A very remarkable series of beds, consisting of calcareous sandstone passing into limestone, and decomposing into a soft pulverulent mass, full of fossils, immediately succeeds the plant sandstones. In this group of beds, which is about 180 feet in thickness, a peculiar group of fossils, of which some are undescribed, occurs. Two of the most remarkable are figured in Plate II.

Figure 7, *Modiola Woarwoyensis*.—This modiola resembles in some respects the common carboniferous fossil, called *Lithodomus dactyloides* by Professor M'Coy; but is of smaller dimensions, and characterized by fine, well-marked, longitudinal lines radiating from the umbones, but not reaching to the margin. The lines of growth are well shown. I have called it Woarwoyensis, from the name of the locality, where it is found in abundance, and was first discovered by me, viz., Woarwoy Bay.

Length		= 1·33 in.
Breadth	(anterior)	= 0·49 „
„	(posterior)	= 0·52 „

Figure 8, *Sanguinolites Woarwoyensis*.—This species in some respects resembles the *S. sulcatus* of Phillips, to which it is allied. Posteriorly, the ridges are as well marked as in *S. sulcatus*; but the bifurcation is much less distinct, and the species is considerably smaller.

Length	= 0·45 in.
Breadth	= 1·07 „

The beds in which these fossils occur are characterized by a well-marked group of fossil remains, which occupy a definite position immediately above the plant sandstones. The following are the most abundant of the species:—

Orthis crenistria.
Atrypa fallax.
Reticularia (*Sp.*)
Productus caperatus.
P. antiquatus.
Modiola Woarwoyensis.
Sanguinolites Woarwoyensis.
Actinocrinus (*Sp.*)

The beds just described are succeeded by thick beds of yellowish sandy limstones, alternating with gray flaggy sandstones and shales, which are literally covered with fragments of fishes' teeth; and these beds are again succeeded by others containing abundant casts of fucoids. The total thickness of the fish teeth and fucoid beds is 71 feet.

The remainder of the older limestone beds of this district which underlie the dolomite beds, are composed of flaggy limestones, with black shaly partings, and alternating layers of blue shaly limestone.

The total thickness of the series, including the two groups already mentioned, is 851 feet. About the middle of the series, a band of fine shaly limestone occurs, under Loftus Hall, which contains an extraordinary abundance of two varieties of Carboniferous Trilobites, viz., *Phillipsia gemmulifera* and *P. quadriserialis.*

The entire group is terminated on the south, and overlaid by a band of dolomite limestone, extending from the rocks at the south point of Patrick's Bay on the east to a point about 300 yards S.W. of Duffin's Well on the west or harbour side.

The older limestone, like the newer limestone which lies above the dolomite, is marked by a profusion of fine fossils, of which the commonest are—

Fenestellidæ.
Milleporidæ.
Favosites megastoma.
Lithodendron pauciradiale.
Syringopora geniculata.

Spirifer clathratus.
,, attenuatus.
,, plebeius.
Leptæna analoga.

Orthis filiaria.
O. crenistria.
Athyris concentrica.
A. squamosa.

*Orthoceras attenuatum.
*Euomphalus pentangulatus.
*Pileopsis vetusta.
*P. tubifer.

*Phillipsia gemmulifera.
*P. quadriserialis.

The fossils marked with an asterisk were not found in the limestone above the dolomite, and appear to indicate a shallower sea than that which subsequently existed.

We may suppose that the depth of the water, during the deposition of these beds of flaggy limestone and calcareous sandstone, was greater than during the period of the plant beds, or Old Red conglomerate; but the presence of such fossils as Trilobites, Modiola,

&c., leads us to conjecture that the depth of the water was moderate, probably not exceeding 70 feet.

4. DOLOMITE BEDS.

The limestone beds of the Hook peninsula are divided into two nearly equal portions by a very remarkable band of dolomite, quite unfossiliferous, or presenting only traces of nearly obliterated fossils, with some obscure remains, which are either casts of fucoids or of annelid burrows. I estimate the thickness of this belt of magnesian limestone at 385 feet; it is conformable, both above and below, to the flaggy limestone which preceded and followed it. I think it probable that this band of dolomite corresponds with the lower magnesian band described by Mr. Wyley in his account of the lower Carboniferous limestone of Kilkenny and Carlow.* It resembles it in physical characters, in the absence of fossils, although interposed between limestone beds remarkably fossiliferous; and it occupies the same geological horizon,—Mr. Wyley's dolomite lying 1100 feet above the base of the lower Carboniferous limestone, and the dolomite of Hook being about 900 feet above the uppermost plant beds of the Yellow Sandstone series. They are also comparable in point of thickness, the dolomite of Kilkenny being 200 feet thick, and the Hook dolomite 380 feet.

5. NEWER LIMESTONE BEDS.

The beds of limestone which rest conformably on the dolomite, and extend southwards to Hook Lighthouse, are 981 feet thick; they resemble closely the upper beds which underly the dolomite, and are composed of flaggy limestone, with alternations of black calcareous shale, the unequal weathering of which gives rise to a fine development of beautiful fossils on the exposed surface of the thin-bedded limestones. A remarkable series of limestones, containing fish teeth and spines of large size, of the genera Psammodus and Ctenacanthus, accompanied by myriads of *Orthis filiaria*, rests upon the dolomite, and occasional fine specimens are found throughout the entire series; the large size of the fish teeth, and their perfect preservation, coupled with other circumstances, lead us to believe that the water, which had been gradually deepening from the period

* Geol. Soc. Dub. Journal, vol. vi., p. 109.

of the deposition of the red conglomerate, had now reached its greatest depth, and had become the residence of creatures accustomed to provide their food in regions of the ocean remote from land. The following list, although far from perfect, contains the most common forms of fossil remains found in the limestone beds above the dolomite:—

Turbinolia fungites.
Favosites megastoma.
Fenestellidæ.

Palæechinus ellipticus.
Actinocrinus triakontadactylus.
Poteriocrinus punctatus.

Psammodus porosus.
Ctenacanthus.

Cyrtia laminosa.
Athyris concentrica.
Athyris squamosa.
Spirifer speciosus.
Sp. clathratus.
Productus Scoticus.
Orthis crenistria.
O. filiaria.

It would be easy to add to the foregoing lists; but I have been more anxious to give an exact account of the species found, whose locality is certain, than to give a larger list, with a less precise determination of locality. In the lists already given the precise position of each is certain, and this circumstance gives a value to the catalogue which it would not otherwise possess.

It is necessary, in conclusion, to say a few words on the geological age of the entire group and its subdivisions. The occurrence of such fossils as *Athyris concentrica*, *Athyris squamosa*, *Spirifer clathratus* (which I believe to be only a variety of the *Spirifer disjunctus*, or *S. Verneuilli*), is sufficient to determine the position of the limestone beds as belonging to the lower portion of the Carboniferous system. The plant beds are the Yellow Sandstone of Dr. Griffith, or the Upper Devonian of the Geological surveyors. One of Mr. Griffith's divisions is lithologically absent, viz., the Carboniferous slate; but it is represented palæontologically by the entire limestone group. It is not possible to identify, bed by bed, the series here described with any system of subdivision proposed for the lower Carboniferous system; but I think no person, considering the district fairly and fully, can avoid coming to the conclusion that any line drawn in it must be arbitrary, and particularly so one separating the lower portion as Devonian from the upper as Carboniferous, when not a single characteristic Devonian fossil has been found in it, nor, so far as I am aware, in any other part of Ireland.

Too much importance has been attached to systems and system-makers hitherto in Geology; and many of the controversies waged, respecting Silurian and Devonian groups, have had their origin, or, at least, owe their continuance, to a desire on the part of the controversialists to extend, beyond their due boundaries, merely local subdivisions and names. The group of rocks described in this notice is a continuous whole, and should be viewed as such. The plant beds, on which the difficulty of classification has principally turned, ought, in my opinion, to be classed with the Carboniferous system, as they contain forms of plants, such as Knorria, which are recognised in Germany and elsewhere as eminently characteristic of Carboniferous beds.

I have already pointed out what I conceive to be the relative positions of the Limestone groups, and the lower Limestone subdivisions of Kilkenny. I now append a Tabular View showing this relation; and add, in another column, the corresponding beds described by me as the lower Carboniferous beds of the Menai Straits:—

Comparative View of Lower Carboniferous Rocks in Wexford, Kilkenny, and Carnarvon.

Wexford.	Feet.	Kilkenny.	Feet.	Carnarvon.	Feet.
1. **Old Red Sandstone.** Conglomerates alternating with red sandstones, ...	1150				
2. **Yellow Sandstone.** Alternating beds of red and white, or yellow sandstones, with red conglomerate, ...	382	**Lower Limestone.** 1. Lower shales, alternating with sandstones,	450	1. Yellow sandstone with plant remains, alternating with crystalline limestone and red shale, ...	204
Lower Limestone. 3. Lower Division. Arenaceous in lower beds, and shale partings in upper beds, .	851	2. Dark gray limestone, with shale beds and partings, ...	650	2. Nodular red and calpy brown limestones, highly fossiliferous, ...	390
4. Dolomite. Gray, splintery, and coarsely crystalline, dividing into rhombic fragments, ...	385	3. Lower Dolomite, . .	200		

Wexford.	Feet.	Kilkenny.	Feet.	Carnarvon.	Feet.
5. Upper Division. Alternating limestone and black shale, thinly bedded, . . .	981	4. Shaly, fossiliferous nodular limestone,. .	330		
		5. Upper dolomite and cherty limestone, . .	250	3. Pink crystalline limestone, with bands of chert,.	526
		6. Middle Limestone, Black marble,.	820	4. Red conglomerate and associated coarse limestones and sandstones, ...	450
		7. Upper Limestone. Thick-bedded, massive, crystalline, gray limestones, . . .	1500		
				5. Red shales and marl beds of the coal-measures, ...	160
Total, ...	3749	Total, ...	4200	Total, ...	1730

The Society met on the 9th of April, 1856, on which occasion the following Paper was read.

THE IGNEOUS ROCKS OF THE BEREHAVEN DISTRICT. BY G. H. KINAHAN, ESQ., GEOLOGICAL SURVEY OF IRELAND.

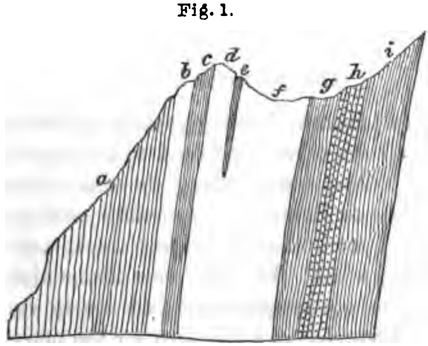
These Rocks occur in three different geological formations, viz., Old Red Sandstone, Yellow Sandstone, and the Carboniferous Slate. In the Old Red Sandstone, where they are principally in the large mass of purple and green slates and shales which are situated near the junction with the Yellow Sandstone, they are all greenstones, with one or two exceptions. They appear in two distinct districts, to the north and south of the Allihies Mines. I shall begin by making a few remarks on the northern district.

THE NORTHERN DISTRICT.

The principal part of the northern trap district is situated to the north-west of the Mines, and south-east of Cod Head, as the promontory to the north of Ballydonegan Bay is called, and stretches all along the north-west coast of Dursey Island out to Dursey Head. The igneous rocks here seem to be divisible into contemporaneous and eruptive traps. The contemporaneous traps, the beds of which average generally about forty yards thick, are, for the most part, at least in their under portions, of a compact greenstone, with here and there veins of a light green colour, with small asbestos veins, and, in some places, minute crystals of asbestos disseminated through it. There are veins of quartz, compact and crystalline; also, thin flaky partings in the joints, of opal, of a greenish hue, besides crystals of iron and copper pyrites. The copper pyrites is only to be found among the asbestos; and, in some places, small distinct crystals of felspar and hornblende.

For about three or four feet of the upper part of the bed, it changes its nature, becoming very ashy, and full of small round pockets, about a quarter of an inch in diameter, of decomposed oxide of manganese; also crystals of iron pyrites. The Dursey Island trap seems to be a continuation of one of the Cod Head beds of trap, and appears to be confined to the north-west portion of the island; but about this it is hard to be certain, as the island for the most part is covered with drift and bog, and the coast section is the only place affording good data. The bed of trap at the eastern end is divided into two by a bed of altered slate, about four feet thick, which seems to die out, as it is not to be found as you follow the

Fig. 1.



a, Slaty grits.	*f*, Greenstone.
b, Ashy greenstone.	*g*, Purple slate.
c, Altered slate.	*h*, Green grits.
d, Greenstone.	*i*, Purple slate.
e, Bed of altered slate.	

trap on to the west. The higher bed of trap lying on the top of the altered slate is very ashy, and resembles the highest portions of the beds on the mainland at Cod Head. The lower bed seems to have been poured out at two distinct periods, as, on going further west, a small bed of altered slate is found in it, about one foot thick in the largest place, dying out after going about forty feet to the east; and at about thirty feet below the surface, as seen by the coast section (Fig. 1), which at that place cuts right through the beds, showing a magnificent transverse section; it is then traceable to the north side of Dursey Head, where it disappears in the sea.

The eruptive traps all spring from a large, irregular centre, with dykes running out on all sides,—some carry on for a good distance, but none of them are traceable for more than five hundred yards, while some do not exceed fifty, and generally end most abruptly. They seem to have been in action at a later period than the contemporaneous traps, as many of the beds with which they have come into proximity are twisted and contorted to a great degree. It would seem to have been the great boiler (if I may so call it) for one of the subsequent volcanic eruptions which took place in this neighbourhood. They are, for the most part of the same nature as the contemporaneous trap, but do not seem to have any ashy portion in them.

There is also a small greenstone dyke to the north of the Dooneen Mine, which seems to belong to this period; also a few small dykes in the mountains, to the south-east of the Mine Valley, which may be placed in the same classification.

THE SOUTHERN DISTRICT.

These traps (a pale, ashy-looking greenstone) have a most marked difference from all the others, and seem to have no connexion with them whatever. They range along the coast from Crow Head to about half-way to Cahirmore, generally running very small; the largest is not more than three feet thick, and most of them about one foot and a half, the small ones about nine inches; none of them seem to be contemporaneous; all nearly vertical, dipping to the north, and running in a direction for the most part E. 15 N.; they are not easily traced, on account of their small size, and the country being covered with drift and bog. They are to be seen to the best advantage on the north-west side of the Crow Head promontory. Going to the eastward toward Cahirmore, to the point to the east of Firkeel Bay, there is found a small oval mass of volcanic matter, of an ashy appearance. It seems to be contemporaneous, having the same stratification as the surrounding slate;

but that appearance is hard to be accounted for, as there is a number of ashy-looking dykes branching from it to the south-east and north-west. There is also a dyke to be found farther east along the coast; but it is not traceable all the way, on account of the drift, though it seems most likely to have had its origin at this spot, as also all the dykes at or near Crow Head. This has all the appearance of having been the vent of a small submarine volcano, as all the dykes which seem to be connected with it are of a very flaky nature, and such as one could imagine a volcanic ashy mud to become, on being consolidated. The slate underlying seems to be altered for the space of two or three feet.

There are also a few seemingly contemporaneous traps at Drumsharra Point, about 500 yards west of Pulleen Harbour, running about two feet thick; they do not seem to be very extensive, as they are not to be remarked anywhere else. One of them is a felstone porphyry, very like syenite in appearance; the other is very like a serpentine. They are close on the junction of the Old Red and Yellow Sandstone. There is also a felstone dyke to be found on the road leading from Dunboy to Pulleen, and another in Dunboy Wood; they are felstone, and lie in the direction of the bedding; but the beds on either side are slightly altered. These are the only felstone dykes that were found in the Old Red Sandstone formation.

YELLOW SANDSTONE.

The Yellow Sandstone in this district is not strongly developed, being only 700 or 800 feet thick; the principal igneous feature is a contemporaneous felstone, about 30 feet thick, traceable from the coast about 500 yards west of Drumsharra Point to the coast near Cahirmore, where the Yellow Sandstone disappears in the sea. It is to be traced all the way, with the exception of a few small breaks. It is a bluish felstone porphyry, with white felspar crystals very widely disseminated through the mass. It is displaced by two faults. There are also two or three small beds of felstone near Drumsharra Point, and one hornblende dyke; but none of them are of much consequence. On coming to Cahirmore you find a number of small greenstone dykes, which make their appearance there; and a roundish mass of trappean breccia, which seems to be contemporaneous, to which reference will be made at a future period.

CARBONIFEROUS SLATE.

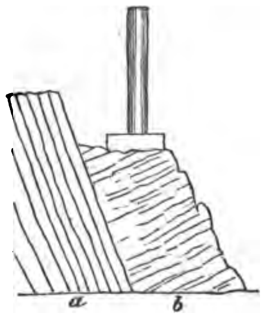
This formation is very rich in igneous rocks; they make their appearance from about the centre of Bere Island, and carry on until the Carboniferous Slate is lost in the sea at Cahirmore. They appear principally in the grits called by Mr. Jukes Coomhola grits, from their being highly developed at Coomhola, near Glengariff. They lie lowest in the Carboniferous series, and are the principal representatives of it along the north side of Bantry Bay, in the Berehaven district,—there being very little Carboniferous slate proper developed therein. The traps at the Bere Island end will be first spoken of.

In Bere Island the igneous rock seems to be divisible into five classes,—conformable and unconformable greenstone, conformable and unconformable felstone, and felstone ash. The only legitimate beds of ash are felspathic, though most of the greenstone dykes have more or less of a flaky structure, resembling ash. The felstones for the most part are seemingly conformable,—the greenstones, not.

At the south-east of the island, under and near Tower No. 3, there is a system of conformable felstones, which seem to be contemporaneous, as the top of the beds are more or less ashy; and they generally become so before dying out. They are of a bluish colour, with a few crystals of white felspar widely disseminated through them. The blow-pipe has little or no action on them; no greenstone makes its appearance in this part of the island.

At the N. W. corner of the island, near Redoubt (No. 5), the trap all seems to lie conformable, being chiefly felstone, with one or two greenstones. These are traceable a short way to the east, where they are lost in the drift. A few of them can be traced as far as the Telegraph Tower; they do not go much further, if past it, as they are not to be found in the hill at the other side of the drift. Going further south, you find the strata and conformable trap cut up by a system of dykes; the traceable ones are ashy-looking or flaky greenstones; and along the coast are some small felstone, which, on account of their small size, are impossible to trace. The greenstones run every way; but the principal ones take a N. E. direction, and some of them run as far as the Telegraph Tower; they dip at an angle of 85° to the N. and N. E., and are on an average about 2½ feet thick; some of them end in bosses of a compact greenstone. Under the western light-house at Ardnakinna Point, there is a large felspathic trappean breccia, having a white felspathic base, enclosing pieces of altered slate, grit, &c., breaking into five or six dykes. At the western side there is a section (Fig. 2) seen on the cliffs, where it seems to be conformable; but it is not so on the east side, though the dykes, if not contemporaneous, run along the beds, as seen by the coast section. To the east of the light-house, going along the coast, you find conformable felstones which run in an easterly direction with the bedding of the surrounding grits and slates, but are cut up in two or three places by the greenstone dykes.

FIG. 2.

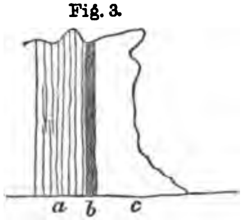


a, Slates and grits.
b, Trap.

At the farthest south side of the island there are two large felstone beds, with greenstone dykes running across them, which are seen in the grits and slate, but do not appear through the felstone, whose resistance seems to have been too great for them, they being raised and twisted in the places where the dykes ought to be.

There is a valley in the centre of the island due south of the Telegraph, which seems to have been the centre of action for the greenstones, as the felstones do not cross it, though they appear in the mountain that bounds it on the east. South-west of No. 4 Tower, in the valley, there is a large boss of greenstone, and innumerable small dykes, running mostly in a westerly direction. On the eastern side of the valley is a cliff full of small felstone traps, which seem to be conformable; also, one greenstone which begins at the cliff, as a hornblendic felstone; then changes into a beautiful porphyry, and then into a compact greenstone. All these beds die out or are lost in the drift. Due south of the valley there are principally felstones, with a few greenstones. To the west of that along the coast, the only place where the traps are seen, there are only felstones, a few of which are dykes; the rest are conformable,—some traps, others ash. The dykes run very small, none of them are over, and a few up to two feet in thickness; they are very compact, of a reddish hue, and sometimes very grit-like. Due south of the Telegraph along the coast are two masses of tabular, hornblendic felstone, with one or two greenstone dykes running through them. The felstone traps, all except a few of them, seem to have been contemporaneous with the grit and slate, but, as the period went on, they become more hornblendic till you come to the uppermost bed on the south of the island, where they are hornblendic felstone, nearly approaching a greenstone. These are in some places conformable, in others not, as seen by the sections (Figs. 3, 4, 5, and 6, which are all sections taken at different places of the same mass of trap) at the junction with the grits and slates. They fused slightly with the blow-pipe. After

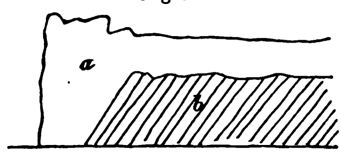
Fig. 3.



West end of Tabular Trap, looking east.

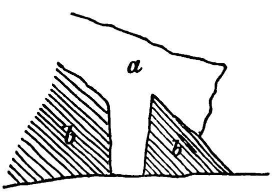
a, Slate. *b*, Altered slate. *c*, Felspathic greenstone.

Fig. 4.



a, Trap. *b*, Slate.

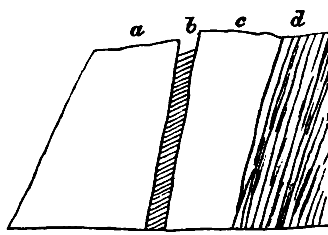
Fig. 5.



Looking east; Slate dipping west.

a, Trap. *b*, Slate.

Fig. 6.



Further east, looking west.

a and *c*, Trap. *b*, Slate. *d*, Slate.

this period the greenstone dykes seem to have been formed. The greenstones are a much darker green than those in the Old Red Sandstone at Cod Head and the Dursey; the dykes are very ashy-looking, or flaky, but generally have here and there through them compact portions, or end in a compact boss. The conformable felstones are either bluish or white, with crystals of felspar widely disseminated through them. The ashes have also crystals of felspar, but none of them become a regular porphyry, as seen in the Kerry traps. The age of the felstone dykes is hard to be fixed, as they only appear on the coast, and in no place were they found in contact with the greenstone dykes.

We shall now go to the mainland, and begin, as we did on Bere Island, by remarking the lowest beds. Just at the junction of the Yellow Sandstone and Carboniferous slate, there is a large massive bed, about 80 feet thick, of green, compact felstone, traceable from the extreme south of the Dunboy Wood to near Pulleen Harbour. It is twice broken by small, white felstone dykes (about ten feet thick). The first you meet, going from the east, causes a downthrow of about 200 feet; the second cuts it off, and after that it is not to be found; though there is a bed, which seems to have the same mineralogical appearances, to be found on the N. W. of Black Ball Head; but that lies much higher in the geological series. At Fair Head, and along the coasts N. E. and W., are to be found beds of felspathic trap, and ash and greenstone dykes. The felstone traps are very well developed a little south of the last-mentioned bed, making their appearance as beds; but, on going more south to Fair Head, becoming tabular. The greenstones are mostly small. All of these traps are very like those on Bere Island. Going now to the west of Drumsharra Point—as here the Carboniferous slate is all denuded away to make Pulleen Harbour—we come on a large, well-developed igneous district, full of dykes and beds; but we find them very like Bere Island, felspathic near the Yellow Sandstone, and, as you go higher in the series, becoming more or less hornblendic, being sometimes conformable and unconformable, as shown by sections, like those before mentioned when speaking of Bere Island,—the whole of it cut up in some places by greenstone dykes. We shall leave it, and go west to Black Ball and White Ball Heads. On the N. W. of Black Ball Head there is a large, irregular mass of trappean breccia, a greenish-brown, earthy base, with partially rounded crystals of hornblende, often two inches across, and veins of asbestos; outside this, a breccia of fragments of trap, slate, grits, primary limestone, and other kinds of rock. On White Ball Head there are to be found four dykes of breccia, very like that first mentioned, running in a N. W. direction, bearing direct for the breccia, before spoken of among the Yellow Sandstone traps, which breccia is very like the outer breccia on Black Ball Head. The breccia on Black Ball Head would appear to have been the vent of eruption of a submarine volcano, and the dykes on White Ball Head, and the mass on the mainland, part of the funnel thereof. The Black Ball breccia appears to have been contemporaneous with the mass of slate, and there must have been an aqueous force in action at the time of its formation, as the mass is blended in with the surrounding slate, coarse near the centre, and getting finer as it recedes therefrom. Out of it there proceed a number of dykes, most of them felspathic, but a few hornblendic, which are partially intrusive at their origin; but they seem, at a little distance from it, to run evenly between the beds. At the north of White Ball Head there are two very crystalline greenstone dykes, which are not traceable far; also at the point there is a thin bed, about two feet thick, of trappean breccia running for about 300 yards, and then changing into a slaty grit. It would seem that just at this period the volcano made a slight movement, and that the aqueous power had spread its *debris* over the bed of the ocean. To the north of the breccia on Black Ball Head there is a system of dykes close together, one of which is very like the green compact felstone mentioned before, near Dunboy.

Under the Black Ball Tower there is a large mass of greenstone, quite different from any other of the greenstones found in the Carboniferous rocks of the district: in the first place it is contemporaneous; it lies a good deal higher in the series, being up among the black slate; and it is compact, very like the dykes found in the Old Red at Cod Head, only that it has not the light green patches with asbestos in them. It seems to have been poured out at two distinct periods,—as at the east side there is a small bed of green and black slate, about nine inches wide, which runs through the mass under the Tower. This finishes the trap in the Berehaven district.

THE Society met on the 14th of May, 1856, on which occasion the following Paper was read.

ON THE PROBABLE EXISTENCE OF FOSSILS IN THE LIMESTONE OF CULDAFF, COUNTY OF DONEGAL. BY PATRICK GANLY.

FROM the data supplied by the publication of Mr. Griffith's Geological Map, it may be easily shown that the slate group composing the valley of the Foyle is the newest portion of the primary series in the north of Ireland; but it would appear from observation, that, although connected with our oldest sedimentary deposits by a conformable sequence, these strata agree in lithological aspect rather with the base of the Silurian System, as in Wicklow and Wexford, than with the more prevailing rocks of the primary series in Galway, Mayo, and Donegal, and generally consist of black, shining clay-slate, frequently alternating with white quartzite, and occasionally with gray crystalline and compact limestone.

The limestone, however, is chiefly confined to the base of the group, and attains its greatest development in the neighbourhood of Culdaff, where, though much disturbed by extensive protrusions of greenstone, it presents a succession of beds fully four hundred feet in thickness, remarkable for the greater part in containing an abundance of symmetrical concretions disseminated through the rock, in the manner of fossils, amongst more recent strata.

The concretions are usually found isolated, and of different forms, but those of most frequent occurrence are somewhat semi-globular, and vary in size from two inches to a foot in their greatest dimension. On the principal fracture they always exhibit a radiated structure, and after more detailed examination appear to be composed of a mass of truncated pyramids, terminating on the base or outer surface in a network of irregular polygons, which seldom exceed one-third of an inch in diameter.

Whether the specimens be compact or crystalline, their internal structure is still the same; and in relation to the strata in which they occur, it is not observable that the sedimentary lines of the bedding pass in any case through the enclosed concretions, nor that the radiating jointage of the latter ever extends into the surrounding rock; so that, taken as integral masses, these concretions would seem to be of anterior origin to the beds in which they are found, and cannot, therefore, be supposed the result of mere metamorphic action induced at a subsequent period.

Under those circumstances, and in the absence of a better hypothesis, I think the concretionary structures in question may be rationally regarded as organic remains, in which the specific characters have been obliterated, and as probably referable to some genus of zoophytes, composed of adhering tubes, of which we have familiar examples in *Halysites catenulatus*, *Favosites Gothlandica*, and *Lithostrotion striatum*.

This conclusion, with respect to the semi-globular masses, is by no means invalidated by reference to others of a different kind, for these in many cases occur as small compressed cylinders, about two inches in length, and of nearly half an inch in diameter, suggesting the idea of Encrinite stems, or of broken Orthoceratites; and in one particular instance a concretion was found, almost identical with both valves of an ordinary Productus.

Thus, the observed facts, whether taken collectively or in detail, would appear all and each to indicate the probable existence of fossils in the limestone of Culdaff; and I have to hope that sufficient has been stated to induce further attention on the part of geologists to the rocks of the primary series.

THE Society met on the 11th of June, 1856, on which occasion the following Papers were read.

OBSERVATIONS ON THE STRUCTURE OF STRATA. BY PATRICK GANLY.

1. *Succession of Laminæ.*

ON the assumption that loose matter, accumulated by the action of water, assumes a chronological arrangement, geologists are enabled to establish the relative ages of a series of sedimentary rocks from their order of superposition, which may in general be easily determined by observation, so long as the strata lie level, or at low inclinations to the horizon; but becomes a question of considerable difficulty when they stand nearly vertical, or happen to be altogether turned over.

To ascertain the true succession in cases of this kind, will sometimes require a good deal of technical artifice, such as tracing out the doubtful strata by their strike, to a less disturbed locality, a reference to lithological character and organic remains, or even to the original structure of the rock itself, should the ripple-mark or drifted ridges be well exhibited in the bedding.

By the last of these methods the sequence of the strata is deduced from the relation of their component laminæ, either on the principle that the layers are attenuated from the top towards the bottom, or that newer groups rest unconformably upon older ones. And that such is very constantly the fact, may be shown by observing that in the ripple-mark formed on the bed of a river, the matter eroded from each of the furrows becomes stratified on the sheltered side of the next adjacent down-stream ridge, and that during the transfer the coarser particles remain hindmost and uppermost, sloping at a steep inclination, whilst the finer portions are carried forward to a lower position, and lie nearly level. Under this process the drifted matter deposited will evidently thin out along the surface of repose, from the summit to the base; and as its profile will form a curved layer differently inclined to the horizon at different points, it is presumable that, in the progress of accumulation, the lower or level parts of newer masses will generally rest upon the upper or highly inclined edges of older groups, and thus give rise to frequent unconformabilities.

In illustration of these views, a few sketches are subjoined from observation.

Fig. 1.

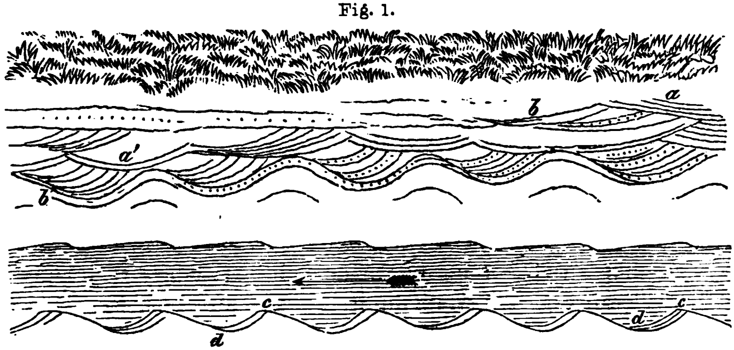
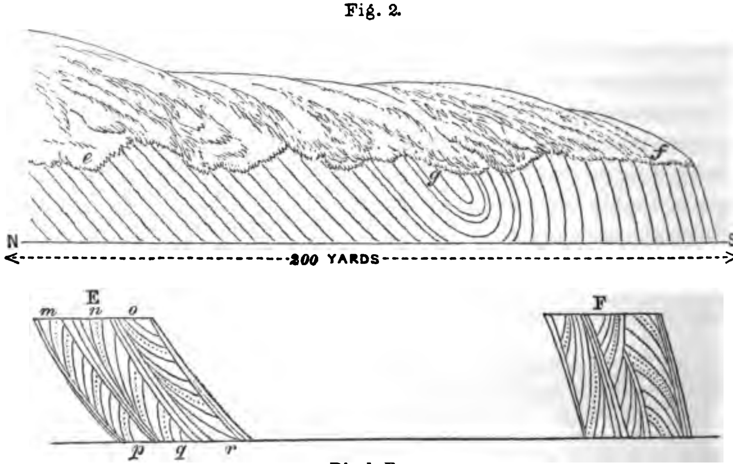


Fig. 1 is a section from the valley of a river about two miles north of Carndonagh, in the county of Donegal. In the lower part, the river with the ripple-mark on its bed is represented. The arrow indicates the direction of the current, and sedimentary layers, thinning out from the top towards the bottom, are shown on the sheltered side of each of the ridges *c*, *d*. A few feet above the level of the river, in the adjacent bank, a laminated deposit of sand and clay is exposed, which also exhibits the ripple-mark, and appears to be the result of the river's action at a former period. In some parts the laminæ are homogeneous sediment, and are, therefore, of uniform thickness; but in general the layers are composed of partly fine and partly coarse materials, and present an attenuated profile from the crest of the ridge downwards, in a sloping direction, as at *b*, *b′*. Several examples of unconformable succession are likewise visible, caused by the embedding of the newer upon the older laminæ, as at *a*, *a′*.

Fig. 2.



Dingle Bay.

Fig. 2 is a section from the Silurian rocks of the county of Kerry, which occurs on the north shore of Dingle Bay, at Coosnagloor, near the southern base of Mount Eagle, and is here introduced as affording an application of the foregoing principles to practice. In this locality all the strata dip in the same direction, namely, to the south, and might be mistaken for an entirely ascending series; but by reference to their sedimentary structure at *e* and *f*, a synclinal convolution was indicated for the first time, and afterwards proved to exist by a careful examination of the bedding. Enlargements of the lamination at these points are given at E and F, from which it will be seen, either on the principle of *attenuation* or *unconformability* of the layers, that the strata at E are in their natural position; but that those at F have been overthrown to the northward. This section is about 200 yards in length; for the whole of Fig. 1, the scale is about two inches to the foot; and in both cases the aspect is westward.

ON THE TRAPPEAN ROCKS IN THE NEIGHBOURHOOD OF KILLARNEY. BY MR. FREDERICK FOOT.

In the course of my duties on the Geological Survey in the vicinity of Killarney, I met with a large extent of trappean rocks, and as their existence in this locality is not generally known, I consider them well worthy of notice. The most westerly point where I observed these rocks was a deep and picturesque glen, situated about four miles and a half south-east of Killarney, called the Horse's Glen. It lies between the mountains Mangerton and Stoompa.

The form of the glen is remarkable, being that of an L reversed (⅃),—the lower limb turning towards the west instead of the east. In its north and south portions are situated two lakes, Lough Garagarry on the north, and Lough Managh on the south. The distance from the north end of the former to the south end of the latter is about one mile and a half. At the southern end of Lough Managh the glen turns at right angles to the west, and at the western extremity is another lake called Lough Errogh. The sides of the glen are steep and precipitous, proceeding southwards from Lough Garagarry. The trap rocks are seen on both sides of the glen, lying conformably between the beds of grit and slate, which are at the top and bottom of the cliff, that is to say, they overlie the beds at the bottom of the cliff, near the level of the lake, and are overlain by the beds at the top. When you first enter the glen at the west side of Lough Garagarry, the grits and slates appear to be nearly vertical, or dip south at 85°, but, proceeding southward, they roll to the south at low angles from 10° to 30°. Lines resembling stratification appear in places in the trap, conforming to the bedding of the grits and slates. On the west side of Lough Managh, where there are several contortions in beds of purple grit and slate, the trap is seen plainly overlying them, conformably, and similarly contorted. Its general character is that of a pale bluish-green felstone, having in places concretionary nodules, but it varies from this to a compact green or purplish gray felstone, having a few scattered crystals of felspar. It is in some places highly porphyritic. The beds at and near the junction with the grits and slates are almost invariably ashy beds, varying from a dark green to a pale yellowish-green flaky ash, generally porphyritic. Some beds of dark-green decomposed ash extend from the southern end of Lough Managh, as far as a point opposite the middle of the north shore of Lough Errogh, and are then seen no more. They appear to dip south at 20°. On the western side of the glen, to the north of Lough Managh, is seen a dyke-like mass of hard, dark-green felstone, cutting across beds of green grit, which dip S. 45° E. at 55°. Its direction in plan is N.W. and S.E. Higher up on the cliff it is seen resting on beds of dark-gray, gritty-looking ash. Several long fissures are seen on both sides of the glen, resembling the walls of dykes, the dykes themselves having weathered away.

On the northern slope of Stoompa, three-quarters of a mile east of the south end of Lough Garagarry, is an isolated patch of trap, consisting of a green flaky felstone ash (with crystals of felspar) apparently dipping S. at 80°. Its relative position to the adjacent sedimentary rock is not discernible.

The mountains Eskduff, Benaunmore, and Crohane, lying to the east of Stoompa, and south and south-east of Lough Guitane, are chiefly composed of felstone. Between Eskduff and Benaunmore is a picturesque valley, about one mile in length, through which the Cappagh stream runs north and south into Lough Guitane. On entering this valley from the north side, at about one-eighth of a mile south of a small lake called Lough Nabrean, the trap is seen appearing on the west side. Its relative position with the adjacent sedimentary rocks is not plainly seen, but it has the appearance of resting conformably upon them, the dip being S. at 60°.

It extends westward to a point about one-fourth of a mile from the isolated patch before mentioned, on the north slope of Stoompa; where it ends, there seems to be a fault bearing N. W. and S. E., inasmuch as purple grits and slates strike abruptly against it. No lines of stratification are clearly seen in the trap. It varies in character from a hard, granular, green, flaky felstone, in places ashy and porphyritic, to a green ash.

Near the summit of Eskduff Mountain, the trap forms high and precipitous cliffs, and a little south of the summit, lines like bedding, dipping south, are seen in it.

In places the grits and slates appear extending into the trap, which rests conformably upon them, the boundary between the two being deeply indented, in consequence of the sharp flexures into which they are thrown. At the south end of the valley the stream turns abruptly towards the west, so as to give this glen the same form as the Horse's Glen. The trap ends at the stream, dipping south, and none being seen to the south of it. The southern slope of the mountain towards the Horse's Glen is covered with heather; and no rock is visible further than about half-way between the summits of Eskduff and Stoompa.

On the east side of the Cappagh Valley, the mountain Benaunmore is one mass of felstone, in which lines like stratification are seen in places, dipping south at 40° generally. The trap varies from a dark-green compact felstone to a green porphyritic ash. In some places it is traversed by joints which give it a columnar or prismatic structure. This structure is finely exhibited on the eastern side of Benaunmore, where there is a remarkable ravine or cleft in the mountain, running N. W. and S. E., which is most likely a line of fault. The columns are seen on the east side of this ravine for a distance of about three-quarters of a mile. Where first seen at the north end of the ravine, they incline to the south at an angle of 50° or 60°; but further south they become vertical; some of them are fully 200 feet in height. They are generally irregular five or six-sided prisms, and are composed of dark-green compact felstone. The remarkable appearance that these columns give to the mountain scenery in this place renders it well worthy of a visit, even from an ordinary observer. In some places dykes are seen cutting across the columns, formed of white or pink compact felstone. This ravine terminates at a little mountain lake, called Lough Nabroda, the columnar structure ending about half-way on the west side of the lake. The trap on the eastern side of the ravine is different from that on the west. The columns are seen in places, but are not so extensive or massive. The trap on the east side extends further south of Lough Nabroda than on the west, which is caused by the before-mentioned fault. Where it ends, the grit and slate rocks apparently rest conformably upon it, the dip being S. E. at 50°. Eastward from this, the line of junction is not plainly seen; but it evidently coincides with the strike of the grits, which is W. 30° S., and E. 30° N. A bed of light-green ash lies between the trap and grits; the trap ends abruptly a little N.W. of a small mountain lake called Foiladuane Lake; but the ash bed is traceable further, till apparently cut off by another large fault bearing nearly N. and S., and passing just W. of Foiladuane Lake. Just N. W. of Foiladuane Lake are two singular square-shaped masses, composed either of ash or of soft cleaved trap, with a band of slate and grit between them, dipping at 50°, and cut off on each side by faults, no trap of any kind appearing beyond them.

"Between the range of trap just described, and the summit of Crohane Mountain, the rocks are thrown into a bold synclinal curve, which brings in the trap, again dipping north, and forming all the upper part of Crohane. This trap of Crohane is apparently an isolated basin of trap, with a mass of slate and grit resting in the hollow of it, on the northern slope of the mountain, running through Lough Athovynastooka; both sides of the basin ending abruptly a little east of that lake, probably cut off by a great N. W. and S. E. fault. A very well-marked fault, a continuation of that from Foiladuane Lake, cuts through the middle of this trap, where the little mountain track runs up the north slope of Crohane, from the Glenflesk Valley. A bed of green, flaky ash rests upon all the trap of Crohane, with red and green grit reposing on it, and sometimes alternating with it, the two rocks occasionally forming a breccia."—*From Mr. Jukes' Notes.*

On the south side of Crohane the trap is generally a greenish, porphyritic felstone, having in places white concretionary nodules, varying in size from a nut to a turkey-egg; these nodules being very numerous near the summit.

In some places it is a hard, compact, brownish felstone, with crystals of felspar; and there are several beds of dark-green ash. There are a few instances of the columnar structure here also. A dyke of pinkish felstone cuts N. W. and S. E. through part of the anticlinal, on the S. E. slope of Crohane.

Another large trappean mass occurs at Glenflesk, at a distance of about ten miles from Killarney, on the east and north side of the road leading from Killarney to Macroom. Close to the road, at the boundary of the townlands of Carrigaree and Killeen, is a large mass of trap rock, of an ashy nature, having crystals of felspar in a green base. Beds of greenish-gray grit dipping east at 20° seem to come out from beneath; the bedding of the trap is not clear. The cleavage is distinct, dipping S. 15° E. at 70°. A dyke of pale-greenish felstone cuts through it, bearing in plan N. E. and S. W.; a little northwards the trap changes in character, varying from a green ash, with ferruginous crystals of felspar, to a strong porphyry, with large, irregular crystals of felspar in it. The ash beds here have much the appearance of serpentine. Eastward of the road, and nearly parallel to it, runs a deep gorge, which is apparently a line of fault, giving a displacement of about 150 feet. Green and purple grits and slates on the east, striking against the trap on the west. At the southern end of this gorge, on the western side, is a dyke of pale-green felstone, running nearly east and west. On the side of the hill, north-east of the gorge, the trap is dark, green, and flaky, having a hornblendic appearance, and fuses easily in the reducing flame of the blow-pipe. The line of junction of the trap and grit rocks runs on the west side of, and nearly parallel to, the boundary between the townlands of Carrigaree and Killeen. There is no well-marked junction; but the boundary between the trap and grits seems to coincide with the strike of the latter. Going northwards along this boundary, the trap is generally a bluish-green, granular felstone, in one or two places traversed by joints, which give it a columnar structure. At the north side of the townland of Carrigaree, the trap runs east and west into the sedimentary rock, apparently resting in a contortion of the latter. Eastward from the point, at the road where the trap was first mentioned, and on the southern slope of the hill, is a large outlier of purple slates, green, gritty, micaceous flags, and strong green grits, dipping S. 45° E. at from 0° to 35°, resting on the trap; and S. E. of this the same beds appear overlying the trap, which seems to be similarly bedded. Proceeding N. E., the hill which slopes towards the Clydagh River is all trap, varying from a bluish-green to a dark, reddish-brown compact felstone, with pink flakes. In some places near the edge of the river, the wavy structure is well seen on the surface.

South of Clydagh Bridge, the line of junction between the trap and grit runs nearly east and west; the latter dips south, at from 20° to 30°, and rests conformably on the trap, about one mile east of Clydagh Bridge; in the bed of the river another junction is seen, but the bedding of the rocks is not clear.

The trap is not seen any further to the east. It extends to the north as far as Rodgers' Rock, which is about one mile due south of the western summit of the Paps; here it appears to be bedded nearly horizontal.

It preserves the character of either brown or green compact felstone, with pink flakes. South-west of Rodgers' Rock, the mountain is covered with heather, the trap being seen only here and there in irregular masses.

The length of this mass of trap, from the place first described near the road, to Rodgers' Rock, in a straight line, is nearly three miles.

NOTE TO MR. FOOT'S PAPER, BY MR. J. BEETE JUKES.

The felstone traps discovered by Mr. Foot in the green and purple grits and slates, forming the lower part of the Old Red Sandstone near Killarney, perfectly resemble, in every lithological character, those to be seen in the lower Silurian rocks of Wales, and the S. E. of Ireland. The same may be said of those found by Mr. Kinahan in the upper Old Red Sandstone and Carboniferous Slate near Castleton, Berehaven, where, however, they are associated with greenstones, which are almost, if not entirely, absent near Killarney.

The principal varieties of felstone near Killarney are the following:—

1. The most abundant, a smooth, compact, siliceo-felspathic paste, generally of a pale-greenish or bluish-gray colour, very slightly translucent at the edges. This is the character of the columnar portion of the trap. It is frequently marked, though not in the columnar part, both externally and internally, by fine wavy lines or striæ, of slightly different shades of tint from the mass, often greatly curved or twisted; these remind one of the striæ to be seen in a slag from an iron furnace, as they vary solely in colour, and not in texture. There is no further separation of particles in this variety beyond the appearance of a little shining facet of a crystal of felspar, to be occasionally discerned on turning about a fresh fracture variously to the light. The nodular, concretionary structure men-

tioned by Mr. Foot, is exactly like that to be seen in similar felstone in the neighbourhood of Penmachno (North Wales). The nodules are compact, not different from the mass of the rock, although easily separable from it.

2. A granular crystalline variety, in which the mass is composed of small crystals of felspar, and here and there of little crystalline particles of quartz. The crystalline particles of quartz frequently assume a perfectly rounded and amygdaloïdal form, as if they had been crystallized in small pores or vesicles that had been produced in the mass; but they likewise occur in irregular crystalline forms, entangled among the crystals of felspar.

In these two varieties the overplus of silica originally contained in the fused mass, beyond that necessary to form trisilicates with the alumina, potash, or soda, or whatever other bases the rock may contain, has either remained mechanically mixed in the paste of the general mass, or has crystallized out, as it could on the formation of the felspar crystals.

3. The third variety is a bluish-gray felstone porphyry, with numerous crystals of white or pale flesh-coloured felspar, often as much as one-eighth or even one-fourth of an inch across. Crystalline portions of quartz may occasionally be seen also in this.

In some parts of this rock the crystals of felspar, although exhibiting its characteristic cleavage and lustre, have yet a rounded outline, either oval or almost circular. These must either have been formed in vesicular cavities, like the quartz mentioned above, or else the rock must be an altered "ash," and the felspar crystals have suffered from mechanical attrition before they were deposited in the mass. The ashy appearance of this rock is in some cases increased by its flaky character, but this is in many places perceptible where the flakes do not split parallel to the *bedding* of the adjacent slates, but to their *cleavage*, even when that is very different from the bedding. It looked as if the trap rock were affected by a concealed cleavage, which partial decomposition or weathering *brought out*, and gave the rock its flaky character.

4. A fourth variety of the trap, generally found in its upper portion only, was an undoubted "ash," a perfectly fine-grained, soft, flaky rock, smooth, with rather a soapy feel; easily ground to powder; of a pale greenish tint; translucent at the edges, its powder being nearly white.

Wherever a good surface of the lower part of the felstone is exposed, whatever variety it may consist of, it is almost invariably marked by strong rough lines, which stand out in relief on the weathered surfaces, and run parallel to the lower boundary of the trap, and to the stratification of the grits and slates below. These lines or bands, sometimes half an inch or more across, look exactly like the harder bands of a gritstone that project on a weathered surface. On breaking open the trap, there is no apparent internal structure to correspond with them. I believe they are what the Germans call "streckung." They are often seen in the felstones of Arenig and other parts of North Wales.

The main mass of the Killarney trap is, as described by Mr. Foot, interstratified with and conformable to the sedimentary rocks, and partakes of all their accidents of contortion and dislocation. Some parts of it cannot be less than 600 feet thick, and may be much more; but other parts are not more than half that thickness. It is probable, though by no means certain, that the mass forming Benaunmore, where the great columnar ranges are, is the central nucleus or focus from which these igneous rocks originally spread.

In conclusion, I would only add my testimony to that of Mr. Foot, as to the exceeding interest attached to a visit to these trap rocks, both for their geology and for the wild and picturesque beauty of the glens and valleys, on the sides of which they are to be seen, and which are more rarely visited by tourists than they deserve to be. The view from the summit of Crohane (2162 feet), down, on to the craggy top of Benaunmore, with its two parallel glens, and its ranges of columnar cliffs, across the wild and rugged district of Old Red Sandstone round the head of the Kenmare Valley, to Hungry Hill and Dursey Island on the left, and along the Killarney Mountains to Dingle Bay and Brandon Mountain on the right, over the limestone flat on which rests Lough Lean and Castlemaine—and on turning round along the mountain axis of Old Red Sandstone hills, between the flat country of South Cork, composed of the Carboniferous slate, and the equally flat land of North Cork and Kerry, consisting of coal-measures,—to the distant heights of the Galtees, and where the Old Red again rises from beneath,—is one of the most beautiful and most instructive in the neighbourhood of Killarney.

The Society met on the 14th May, 1856, on which occasion the following Paper was read.

ON THE GEOLOGY OF THE CHINCHAS ISLANDS, PERU, SOUTH AMERICA.

BY JOHN ROBERT KINAHAN, M. B. T. C. D.

The district about to be described consists of three islands situated in the South Pacific Ocean, about twelve miles from Pisco, on the coast of Peru, in lat. 13° 44′ S.; long. 76° 13′ W.

Though small in size, the largest island probably not being more than three miles round, they are and have been for some time the seat of a busy commerce, as they abound in guano; and it was whilst taking in a cargo of this commodity that opportunity was afforded me for obtaining the materials for these notes. The islands are three in number, and surrounded by several large detached rocks. They go by the names of North, Middle, and South Islands.

In their physical characters there is a strong resemblance between them; high precipitous cliffs for three-fourths of their circumference; the rest of their coast line, low cliffs and a few sandy coves,—these latter having more or less complete reefs of rocks crossing their entrance—the beach, wherever it does exist, being a coarse shingle.

The cliffs in the North and Middle Islands are highest at the north-west end of the islands, where it gradually slopes away southward and eastward; the coves already mentioned generally being to the eastward.

In the Middle Island the rock appears to rise gradually from the north, and finally culminates the guano as a conspicuous white rock.

The surface of the North Island, as far as can be seen, is slightly depressed in the centre, having the level broken by rounded prominences.

Narrow channels separate the islands, and are of from a quarter to nearly a mile in width, their depth varying from 2½ to 30 fathoms, the bottom either rock, sand and shells, or gravel. That between the North and South Islands is becoming altered in its characters every day, owing to the enormous quantity of ballast thrown overboard there; but the channel between the Middle and South Islands remains yet unchanged. Owing to the direction of these two islands, it is much narrower and more sheltered than the other; in consequence, the shores on this side of the Middle Island are nearly all sandy. On the day on which it was most particularly examined, the Paraca was blowing fiercely outside, and yet this channel was nearly as calm as a mill-pond. Its depth varies from 2 to 7 fathoms, and in many places, even in the centre of the channel, there is no more than 6 fathoms. The bottom is either fine white sand, small gravel, or rocks; in one part the rock can be traced continuous across the channel.

The rock of the island is a porphyritic granite, intersected by numerous veins and dykes of serpentine trap, varying from 2 inches to as many feet in thickness; greenstone protrusions, some of them of considerable extent, also occur.

The granite is in part broken up by a system of parallel joints, so as to appear like beds, and exhibit evidence of a great disturbing force, being twisted and contorted in various parts; the overlying systems often being unconformable with those beneath, the one set running horizontally, the other curving over them in a strange manner.

The greenstone protrusions are best seen on the shores of the bays, generally overlying the granite, and associated with a coarse sandstone grit.

The trap occurs through all the islands; in the Middle Island in very large veins,—the cliffs on the south side of this island being almost altogether composed of it, in enormous square masses piled one on top of the other; the dykes here also run horizontally, the granite both underlying and overlying it.

Owing to the peculiar formation of the granite, the sea has much effect on it, and all the cliffs and detached rocks around the islands are more or less hollowed out into caves, some of them extremely picturesque, and many communicating with each other, and thus forming fine bridges. In one of these bridges, in a detached rock off the Middle Island, the abutments of the bridge are formed externally of granite, while the arch and inner part of the abutments are trap with squared joints, which in the distance might well be taken for a bridge artificially formed.

Many traces of recent upheaval of these islands are to be found on them, evidences of a raised sea-beach being nearly universal; even the cliffs 200 feet high are capped with a layer of large rolled pebbles of trap and granite cemented together; this layer of conglomerate varying from one to several feet in thickness, and traces of it being found also in the central depressed portions of the island. Beds of coarse gravel grit and of an argillaceous sandstone also occur, and decisive evidence of its marine nature is afforded in a rather extensive bed of fossilized shell breccia, which may be seen on the south-west side of the North Island.

On examination, this latter locality gives the following section:—

Commencing above, immediately beneath the guano, which is here of a very dark colour, and an average depth of six inches, we meet a bed of dark argillaceous sandstone; next, a bed of coarse sandstone grit passing into a shell breccia, the breccia varying in thickness from 1 to 4 feet, and composed of numerous Balani, part broken, part quite perfect, and many in position, all unrolled, preserving their natural sharpness, so that their identification is quite easy. They closely approach *Balanus tintinnabulum*, which species is dredged in the adjoining seas, and in abundance covers the rocks and base of the cliffs beneath, but they do not appear to be quite identical with this species. Along with the Balani are found single valves and broken shells of an Ostrea (this mollusc is not now, as far as can be judged, found here), and a few scattered spines of apparently a Cidaris, the whole cemented together into a very compact mass.

Next, a belt of very fine friable grit, intersected by white veins of anhydrous sulphate of lime, which passes gradually into a very fine argillaceous sandstone, of greenish-gray colour and compact texture, also intersected by the sulphate of lime veins, and in parts deeply stained with iron. In some places this latter bed overlies the shell breccia, and appears to be a continuation of the bed of dark sandstone immediately underlying the guano. These sandstone beds reappear on the other side of the island, and are probably continuous under the guano. Beneath the sandstone lies the usual granite of the island. Not far from the locality described, a thick bed of very coarse conglomerate, apparently identical with that found on the summits of the cliffs elsewhere, separated the granite from the green sandstone; the shell breccia bed is also much thicker.

The greenish-gray sandstone crumbles much under the influence of the weather, the veins of white sulphate of lime, in that case, protruding as thin ledges, in some parts some inches wide. The shell breccia extends along the face of the cliff for some hundred yards in length, but I had no means of ascertaining its extent inland. In many places along this side of the island an ammoniacal incrustation has run down over the face of the cliff; it has evidently drained from the guano above, and has also infiltrated the whole of the upper portion of the rocks, rendering the identification of them very puzzling. Through the kindness of Professor Haughton, I am enabled to lay before you an analysis of the white veins which penetrate the sandstone:—

	Per Cent.
Water,	4·80
Silica,	1·74
Alumina,	1·80
Sulphate of Lime,	90·74
	99·08

Though scarcely within the scope of such a paper as this, as being of much more recent origin, it will be hardly proper to pass over the guano beds unnoticed. Their structure is easily seen here, and is as follows:—Conical ridges, in one case attaining the height of 200 feet, regularly stratified; the strata of various thicknesses, not following the lie of the subjacent rock; the strata of one hill cropping out at the sides, originally, apparently, continuous with those of another, and running horizontally; but I have entered so fully into this subject elsewhere (Journal of the Royal Dublin Society, vol. i. p. 89), that further structural description were superfluous. These beds rest either on the porphyritic granite, the sandstone grit, green sandstone, or coarse conglomerate; when the latter, the lower beds of the guano is filled with boulders, which, though quite hard and rounded when exposed, soon crumble away, and become filled with cracks containing crystals of carbonate of ammonia. Lumps of carbonate of ammonia and of a mixed carbonate and phosphate of ammonia occur, the former as angular broken pieces, the latter as botryoidal rounded nodules in regular pockets in the guano.

The Middle Island does not call for particular description; the masses of trap, as already stated, are much larger here, composing the entire cliffs on the eastern side of the island. The island runs about N. E. and S. W. On the South Island the cliffs around are more continuous than in either of the other islands, and there is but one sandy bay, situated on the east: this, a great number of rocks renders absolutely inaccessible. The channel which separates it and the Middle Island is, as already stated, sheltered; the coast of the South Island here is precipitous, with a broad shingle beach at its base. Access to the top is obtained by clambering up the face of a steep rock, and over a very fine natural bridge. Close to the landing-place there is a narrow gulley in the rocks, through which a great mass of ammoniacal incrustation has run and spread itself over the whole face of the cliff; it has also concreted in the gulley, nearly completely filling it up with a stalagmite-form mass, resembling a frozen cascade. The origin of this is rather obscure. The whole of the cliff here is capped with the coarse trap and granite conglomerate, beneath which a small bed of very fine yellow sandstone (not met with elsewhere on the island) occurs; this is exceedingly limited in its extent, and lies on the granite; the coarse gravel grit takes its place a little higher up the hill: no traces of the shell breccia are found. The other geological characters of the island are similar to those of the north island. The greenstone protrusions are larger in extent, and the granite, especially the cliffs on the western side of the island, exhibit that curious unconformability between its upper and lower portions already mentioned; on this side the granite might at a distance be easily mistaken for a stratified rock, the surface of the rock being curved down towards the water's edge, its section exhibiting a system of joints which accurately follow the line of the curve above.

The only sandy bay in it occurs on the eastern side, and is decidedly the best place for studying the greenstone, a square protrusion of considerable size occurring here. The south side of the cove is ordinary granite, which gradually passes into the greenstone; the junction of the two on the north side cannot be traced, owing to a large bed of fine sandstone grit which fills up the valley between them. The sea is evidently encroaching on this bed of grit, and it appears different in its external characters from the beds described in the North Island, and also in the fact of its not resting on the coarse conglomerate. There is a small bed of similar character in one of the coves looking south-east on the North Island, which is there also associated with the greenstone.

The guano rests on the grit. The hill here is excessively curious, its summit covered with remains of sea-lions (*Otaria jubata*) in scores. This island had not been worked when I visited it; therefore, I can say nothing concerning its surface. The trap is not so abundant in this island, the greenstone apparently taking its place; the summits of some of the highest cliffs are capped with greenstone.

These are the principal observations I was enabled to make regarding these curious islands. Their chief interest appears to be in connexion with the observations already made by Darwin on raised sea-beaches in Chili and Peru. If I might venture to speculate, these beaches are much older than those met with at Callao, as the shells met with, subfossils, at the latter place are still to be found recent there, and those met with here, though closely approaching the recent species, are not absolutely identical. I cannot conclude without returning thanks to Captain John Steevens, of the ship Rienzi, for the many facilities he afforded me while making an examination of these islands; and also must apologize to the Society for my presumption in coming before them with a communication in reference to a science (geology) in which I am altogether unlearned,—which fact will be, I hope, taken as an excuse for any technical blunders the eyes of the initiated may herein detect.

WEDNESDAY EVENING, NOVEMBER 12, 1856.

The first meeting of the Society for the Session 1856-7 was held in 35, Trinity College, on the evening of the 12th November,

Gilbert Sanders, Esq., in the Chair.

The Secretary read the Minutes of the last meeting, which were passed; and the following Paper was read by Robert H. Scott, Esq., C. E.:—

ON THE CARBONIFEROUS BEDS OF KILLYBEGS, CO. DONEGAL.

Having had occasion this summer to make a geological section, I, in company with a fellow-student, Mr. J. A. Russell, selected Killybegs as a locality suitable for the purpose. The strata there are Silurian, mainly converted into mica slate, with sandstone and carboniferous shale appearing in two districts. One of these, which I shall first describe, is the N. W. boundary of the central carboniferous basin of Ireland.

In the Fox's Glen, the bed of a stream which flows into Inver Bay, near St. John's Point, we came on black, shaly limestone, containing a great profusion of fossils. Here we found encrinitic stems, *Atrypa fallax, Spirifer glaber*, and *Orthis filiaria*, with several others. These beds of shale, with some of sandstone interstratified with them, occur along the whole of St. John's Point, as far as we went, which was only to Ballyderlan. In Mr. Griffith's map the whole Point is of the same colour, excepting a small belt at the extreme end, where the lower limestone appears. This we were unable to verify, as the distance by land was very great, and the weather did not suit for going there by sea. Along the shore the most remarkable fossils were, a very large Orthis, which I am told is *O. papilionacea*, and *Lithostration basaltiforme*. Plants have also been discovered in this shale.

We then crossed St. John's Point to a place near Riggagh Back, where we found the same shales as at the other side. At the point of Riggagh there is a small fault, very well marked. About 200 yards to the west of this, we find the junction of the sandstone and shale, which are perfectly conformable. When we passed M'Swyne's Castle we began to find traces of plants in great abundance in this sandstone. At one spot, about fifty yards east of a brook which comes down from Spamount, we came on a lenticular mass of shaly limestone, similar to that which we had just left, and containing the same fossils. This widens out as it goes inland: we traced it for some distance to the back of the village of Dunkineely. It is sometimes very hard to find this bed on the beach, as in some winds it is nearly covered by the shingle, so that it might easily be overlooked. At the point of Darney we found a trap dyke cutting across the bedding in a direction nearly perpendicular to the strike. It is very clearly marked, and is the only place where we observed trap penetrating the sandstone, although we found a good many dykes through the mica slate. About this locality Stigmariæ occur in the greatest abundance. The fossil tree which Mr. Byron discovered last year, and which is in the Museum of the Dublin Society, was found near this dyke. We also found Sigillariæ and some leaves in the shaly beds which occur through the sandstones; however, the species is not perceptible in any of the specimens which we were able to obtain. At Bruckless Tannery the sandstone changes into a red conglomerate; however, the character of the shales is not altered. The lowest beds of this conglomerate are exceedingly coarse; they may be observed very well in the bed of the river at Hollybrook, and in the cutting for a new road opposite Killaghtee Chapel. The mica slate appears underlying the sandstone a little beyond the bridge at Hollybrook.

At Green Island, in M'Swyne's Bay, we have greenish slates with trap overlying them. This island can be reached by land at very low tides. At the back of Carntullagh, the headland which divides M'Swyne's and Killybegs Bays, we found reddish slates and sandstones, of a character different from those at Bruckless, and dipping at a higher angle. These appear to be the beds which are converted into mica slate in other parts. The centre of this headland of Carntullagh, and of that of Drimanoo, at the other side of Killybegs Bay, is occupied by trap, flanked on either side by mica slate.

The constitution of the other district, which commences at Fintragh, three miles west of Killybegs, is similar to that of the district already described, but presents greater variety, in consequence of its being intersected by faults, some of which are of importance. The district is a complete basin, the beds dipping inwards all round. We commenced at Fintragh strand, where we found mica slate, and soon came on the junction with the sandstone, the lowest beds of which were not as coarse as in the other places where we observed the junction. The sandstone in this basin is not marked by such a profusion of fossil plants as that under Dunkineely. In the overlying shale in this place we observed plants in one or two places, very indistinct. It is full of *Turbinolia fungites* and Encrinites, especially the former. It seems to be a purer limestone than that at St. John's Point, being harder, and of a bluish instead of a black colour. It has been worn out into caves in several places. About a quarter of a mile beyond the promontory of the Rinn we came on a fault in the limestone, and further on, before we reached Shalwy, we found beds of black shale, containing nodules, some of which appear to be impure ironstone. This shale has been sometimes used by the blacksmiths of the neighbourhood in place of better fuel, and has been found to serve their purpose to a certain extent. Immediately underlying this bed we met the sandstone again, with abundance of plants: in one locality, close to Shalwy shore, we found a bed of yellowish shale at the bottom of the cliff, with Stigmariæ scattered through it: these are exposed by the action of the sea, which removes the shale from around them, and leaves them protruding from the face of the cliff. Not far from this spot, at the opposite side of the beach, we found a coarse conglomerate, similar to that which we had met with at Hollybrook, and the mica slate underlying it. From this to Muckrossallagh we observed, in two isolated patches, a skin of this red conglomerate, bleached white, resting on the mica slate. This is further exemplified by the appearance of an outlier of this same conglomerate, forming an island at a place where only mica slate appears on the shore. Before we reached Muckross we saw the Pigeon Caves, which have been excavated by the sea at the junction of the slate and sandstone. Their appearance, owing to the light reflected from their flooring of mica slate, is extremely beautiful.

From Muckrossallagh to the extreme end of the headland there is shale similar to that at the Rinn: however, its strike is different from that of any of the other beds along the coast.

We were unable to trace the sandstone inland, owing to our having but little time. From the appearance of the country it seems probable that the mountain of Crownarad bounds it on the western side.

I may add, that we observed sandstone similar to that at Dunkineely, and as full of fossils, at Mountcharles, near Donegal. This we did not notice until we were leaving the country, when we walked into a quarry on the hill, which leads up to the town on the west side, while our car was going up the hill.

Professor Haughton expressed his pleasure at hearing Messrs. Scott and Russell's paper. A controversy had arisen between Irish geologists and some of their friends on the Geological Survey as to the true age of the plant beds in the north and south of Ireland. Mr. Haughton considered that Mr. Scott had clearly established the position of the northern plant beds, as immediately overlying the Old Red Conglomerate; and as there could be no doubt of the true carboniferous character of the plants of Donegal, he thought they threw much light on the corresponding beds of the south of Ireland, which, in his opinion, could not be considered as anything but carboniferous.

Mr. Scott observed that the visitor to Killybegs would have other geology besides that of the carboniferous beds, which would be well worth investigation. There is also in that neighbourhood some of the finest cliff scenery on the coast of Ireland, viz., the cliffs of Slieve League and Glencolumkille, which are at present hardly known, in consequence of the difficulty of communication which has hitherto existed, but which is now to a great extent removed.

J. R. Kinahan, Esq., M.B., then read his paper—

ON ANNELIDOID TRACKS IN THE ROCKS OF BRAY HEAD, COUNTY OF WICKLOW.

All traces of animal remains, how indistinct soever, met with in rocks so low down in the series as the Cambrian, must be looked on as important. I have, therefore, ventured to bring before the Society to-night some unmistakeable animal traces which came under my notice, during the past summer, in the Cambrian rocks of Bray Head, county of Wicklow, and which, as far as I know, have been hitherto undescribed, if not unnoticed. They occur in such abundance, and are so unmistakeably marked, that there can be no difficulty in detecting them. As to their nature, they would appear to be rather animal tracks than the remains of animals, being the filled-up burrows of some borer, probably annelidan. They occur, for the most part, in company with the beds of Oldhamia, although there would not appear to be any actual connexion between the two. The chief beds of them occur on a small cove situated on the N.E. side of Bray Head, immediately after rounding the hill from Bray. Here a number of low-lying, somewhat slanting, beds of green and red slate occur, chiefly as detached rocks lying off shore, but left dry by the tide at low water. The tracks are found also in several places along the whole shore to Greystones, and also on the top of the hill.*

They occur as rounded tubuli, running either vertical to or in the same direction as the bedding; in the former case they present a circular, in the latter an ellipsoidal section. They vary much in appearance, and are of every length, from 1 inch to upwards of 2 feet; and, in diameter, from the thickness of common sewing-thread to 0·3 inch and upwards. There appear to be at least two different kinds of them: some of those running in the same plane as the bedding, differing much from the vertical tracks. These latter are generally long, and of nearly the same diameter throughout, except at their upper extremity, where they spread out into a rounded knob, as though the extremity of the tubes were cupped. This form occurs also running nearly horizontally to the beds; the thread-sized tubuli differ from them also chiefly in the fact of their occurring in pairs. The other set of fossils are seldom more than an inch in length, and taper away to each end. They occur best marked in a gritty red slate, with numerous shining black particles through its substance. The thread worms occur, generally in the red beds, in immense profusion, closely resembling those tracks detected by Mr. Salter in the Cambrian rocks of the Longmynd (Quart. Journ. Geol. Soc., London, 1856, p. 246); they are here associated with *Oldhamia antiqua;* they occur also, though rarely, in greenish-gray beds of *Oldhamia radiata*, being then in the direction of the bedding. The commonest tracks, however, are those first mentioned, which are to be found in the greatest numbers in the beds over and underlying beds of *Oldhamia radiata*, though found even intersecting these beds themselves.

* Since the above was read, the author, in company with R. Scott, Esq., C.E., found, in a compact green rock, traces of a different character from those here detailed, probably molluscan, in company with remains similar to those fossils commonly called "Fucoids," which he hopes to describe at a future period.

One track was found which could be traced from the red bed beneath the Oldhamia, and through, or at least into, a red bed above the Oldhamia. The system of beds in which they are most abundant, as seen here, is generally 5 feet thick, and made up as follows: above and overlying the system, a layer of green quartzose rocks of compact texture, having its surface in parts ripple-marked, and overlaid by a layer of *Oldhamia radiata;* next a bed of red shaly slate, often much disintegrated, with slight traces of Oldhamia and a few vertical tracks; next, a red gritty slate, with black points scattered through it, the tubuli few, and generally of the kind with tapering extremities; next, a compact bed of red slate, intersected in every direction with tracks; the whole bed, as it were, knit together by them; next, a layer of *Oldhamia radiata*, pale-grayish in its colour, from 0·25 inch to 3 inches in thickness; tracks generally few in number (this bed sometimes more or less stained with red); next, a bed of red shaly slate or compact red slate; tracks in the former case few and vertical; in the latter numerous; then a red fissile slate bed, in which I did not detect any tracks (this bed often wanting); then the gritty red bed:—this system, with slight variations, occurring three or four times over, and resting on the green quartzose rocks.

In many places the red beds are much thinned out, and occur only as veins three or four inches thick.

Short vertical tubuli (*vide* Plate V.) occur in nodules, which are abundant in the green quartzose beds in parts. Mr. Salter, who accompanied me here on one occasion, pointed out, on the lower face of one of the beds, rounded knobs corresponding to the cupped termination of the tubuli and rounded elevations, casts of trails of worms on the top of the mud. He also obtained one or two imperfect specimens of these last in the white quartz rocks, which here protrude. Though frequently found crossing, on careful examination I was unable to detect any branching among these tubuli. When closely examined they are found to be made up of concentric laminæ, of about the thickness of ordinary writing-paper, depressed in the centre, like a pile of watch-glasses. In every instance the tubuli are found to be of a different colour and texture from the surrounding rocks, as though their contents had undergone some chemical or other change, such as we know is communicated by recent Annelidans to the sand which passes through their bodies. In some instances the rock in immediate contact with the tubuli was found to be stained of a darker colour, like that which is frequently found in the circumference of the burrow of Arenicola; this is chiefly seen in the rounded, tapering tubuli.

The vertical tubuli found in the quartzose rock differ in shape from the others here described, tapering gradually from above downwards. Even after a very careful examination I could not satisfy myself as to whether any of these animals possessed a tube or not; if they did, it must have been membranous, and many things about the tracks seem to point to its existence, at least in some cases. I think I am justified in stating, that there is nothing more than an accidental connexion between these tubuli and Oldhamia; indeed, it appears nearly certain that some, at least, of the animals, whether molluscan or annelidan, by which these tubuli were made, must have lived not merely posterior to the death of the Oldhamia, whose remains make up these layers, but even after the deposition of a layer of mud on these remains. And I cannot conclude without expressing my firm conviction that a careful research, by other and more practised hands, cannot fail to bring to light even more interesting remains than these here described; for, as may be gathered from the result of this hurried examination, every kind of rock here furnishes us with some trace or other of animal life.

EXPLANATION OF ACCOMPANYING PLATE.

FIG. 1.—Tracks in gray beds of *Oldhamia radiata*;—showing (*a*) vertical tubes; (*b*) thread-like do.; (*c*) laminated structure of tubuli.

FIG. 2.—(*a*) Vertical tubes; (*b*) thread-like parallel tubuli.

FIG. 3.—Tracks from red bed, showing crossing tubuli.

FIG. 4.—Vertical tubulus from green quartzose rock.

FIG. 5.—Tracks in red beds, showing Tubulus curved on itself in connexion with *Oldhamia antiqua*.

NOTE.—The Oldhamia occurring in connexion with the tubuli is not shown in Figures 1, 2, 3, and 5.

Dr. Kinahan exhibited numerous specimens in illustration of his paper, which gave rise to an interesting discussion, in which many of the members of the Society present joined.

WEDNESDAY EVENING, DECEMBER 10, 1856.

J. B. Jukes, Esq., F.R.S., in the Chair.

The Chairman announced that since their last meeting they had to lament the death of their late Assistant Secretary, Mr. Hitchcock, an event which no one regretted more than himself.

Mr. Hartstonge Robinson, and J. Maguire, C. E., being proposed and seconded, were elected members of the Society.

Mr. W. L. Willson then read his paper :—

ON THE GEOLOGY OF THE NEIGHBOURHOOD OF KENMARE.

The valley of Kenmare is about one mile broad at the town, from whence it extends eastwards, gradually becoming narrower for about nine miles, to the village of Kilgarvan. The rock forming the bottom of the valley is the lower carboniferous limestone, which consists of beds of a pale gray crystalline limestone, much jointed and cleaved, the latter giving a thinly laminated and platy structure to the rock. The lowest beds are of a darker gray, and often deep blue colour, and are seen to rest upon blue and black shales and gray grits, with purple slates and sandstones, both upon the north and south of the valley. The general strike of the limestone and other beds in the Kenmare Valley is about 25° north of east; this strike is very constant for miles over this district.

Some good sections of the lower beds of the limestone, and the rocks immediately beneath, are seen here and there along both the northern and southern boundaries, but particularly the latter. I shall notice two or three of these sections proceeding from the town of Kenmare eastward to Kilgarvan. At Roughty Bridge, about two miles from Kenmare in this direction, we have a section which, in descending order, consists of the following rocks :—First, blue and gray thick-bedded limestone, with crinoidal fragments; then a bed of pale purple crinoidal limestone, which rests upon blue and black shales and slates, in the upper part of which are thick calcareous bands abounding with fossils. These beds rest again upon hard gray and yellowish gray grits, with narrow beds of gray gritty slates, also fossiliferous. The latter beds are particularly well seen under the principal arch of Roughty Bridge.* And, finally, these beds rest upon dull red and purple slates and grits, with occasional green bands, the upper portion of which are often calcareous. The thickness of these rocks here, between the limestone and the red slates, is about seventy feet; at the Bridge they all dip to the north at about 70°, but become nearly flat and are much twisted immediately under the Bridge to the south, both in the river and on the opposite side from this spot. The black shales and slates on which the limestone rests are seen to dip suddenly to the south and north again, thus forming a small basin or trough of the lower beds of the carboniferous limestone at this place, about a quarter of a mile west of Roughty Bridge, and immediately south of a place called White House on the map. The limestone is seen dipping north at 80°, and a little north of this again, in an old quarry on the edge of the Kenmare road, opposite Killowen House, the limestone is seen to dip south at 70°. The dip here is well marked by a bed of soft black shale, which divides the thick beds of gray crystalline limestone.

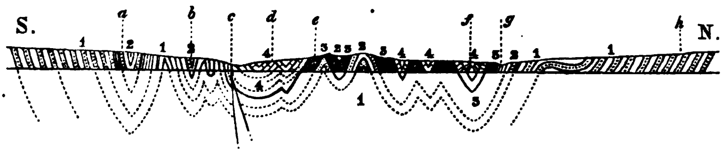
The next place where the dip is well seen in the limestone is in crossing the valley to the north, in the Cleady river, close to Kilpatrick grave-yard, where there is a well-marked dip of 55° to 70° to the south; and further along the northern boundary of the limestone, at Ardtully copper mine, where the limestone is well exposed and fossiliferous, the dip is observed to be north at 80°. Thus it will be seen that the limestone forming the valley of Kenmare does not dip uniformly to the north from the southern boundary, or south from the northern boundary—thus forming one simple synclinal trough of great thickness—but is probably made up of a series of small contortions, from north to south, across the valley, repeating the same beds over again, and thereby dimi-

* Mr. Salter has been kind enough to give me the following list of fossils got near Roughty Bridge:—

Fossils of Carboniferous Slate overlying the thin beds of Argillaceous Sandstone.

Spirifer disjunctus.—Sow.
Strophomena crenistria.—Phill.
Orthis filiaria.—Phill.
Stems of Actinocrinus.
„ Poteriocrinus.
„ Rhodocrinus.
Fenestella, rare.

nishing the apparent thickness we should otherwise have of these beds. Along the northern side of the river Roughty the limestone is seen to form rough mounds and rocky knolls here and there in the ground, being quite massive in outward appearance, but still seen to retain the usual laminated and slaty structure when fractured, and often contained irregular bands of chert. I remarked that the dip surfaces of the rocks which face the valley are much water-worn and rudely furrowed by water-action in that direction. If we now trace this limestone from Clontoo, a little south of Ardtully copper mine, eastwards, we see that immediately east of this place it suddenly changes the hitherto constant strike, and becomes much contorted on its northern boundary. Coming round to the south to Ardtully House, close to which there is a quarry, in which the limestone is seen to have a northerly strike, dipping south-west at 70° north. Close to this quarry at Fassa Bridge the blue and black slates and shales, similar to those beds noticed as the rocks on which the limestone rested at Roughty Bridge, on its southern boundary, are seen dipping under the limestone. From Ardtully House the limestone forms an irregular boundary eastwards, and being contorted, and curving round to the north by Fassa Bridge, is again seen, about 500 feet east of the latter place, in a large quarry close to the old road to Kilgarvan, dipping south at 60°, and resting upon the black and blue slates and shales mentioned as occurring at Fassa Bridge. From this the northern boundary of the limestone continues pretty steady in an easterly direction to the police barrack, situated at the west end of the village of Kilgarvan, and is seen constantly in junction, or nearly so, with the black and blue shales and slates which bound it on the north from Fassa Bridge. But, before leaving Ardtully, I would beg to notice the sudden manner in which this band of limestone, and the rocks southwards (hitherto seen to form a broad band across the valley) narrow from Clontoo to Ardtully. Between Ardtully and Roughty Bridge, on the southern boundary of the limestone, immediately north of Kilgortaree House, on the map, we see the same rocks as we have at Roughty Bridge, viz., gray grit, slates, &c., dipping still north at 80° south of Ardtully House, and in the bend of the river Roughty a good section of he limestone is seen. The beds seem to dip south at 75°, consisting of massive pale gray limestone, then thin beds of fine crystalline limestone, with hard siliceous layers weathering out like chert bands, which are succeeded by thin beds of white and greenish compact marble, separated again by thin layers of pale greenish shale, which do not appear to be calcareous. These beds are seen again in the line of strike, a little to the east of Ardtully Old Bridge, about a quarter of a mile distant from this spot, and appear to dip still south at 55° in the former section; south of Ardtully, immediately south of the chert and siliceous limestones, we see dark red and purple slates and grits apparently dipping north at 80°. If these dips be correct, there must necessarily be a fault along the southern boundary of the limestone cutting off some of the lower beds of the limestone, and the beds immediately beneath it, which we have traced from Roughty Bridge to Kilgortaree House, a mile distant from this point. We see no trace of these beds along here between these points. The fact of a fault existing here along the southern boundary of the limestone would account, in some measure, for the sudden narrowing and apparent thinning of the limestone, as well as the absence of the beds beneath it at this point. I shall now trace the limestone eastwards to Kilgarvan village, where I think there is further evidence of the existence of an east and west fault, which commences a little south-east of the village, and follows nearly the course of the river Roughty westwards, terminating nearly opposite Clontoo, where the limestone suddenly becomes so narrow. From the river Roughty, south of Kilgarvan, up to that village, we see a good section of the rocks. In the river we have dull red and purple slates, parts of which are calcareous; these beds strike nearly east and west, and dip north at 85°; about 200 feet north of the spot, we find strong beds of limestone and black shales striking south-east, and dipping south-west at 45°. Thus, these beds, if prolonged in this strike, would abut against the red slates, which are seen in the river to strike east and west, and dip north at 85°. Therefore, there must be a fault here running nearly east and west down the river Roughty, which cuts off the lowest beds of the limestone, as well as the band of black and blue shales and grits, and the band represented by No. 2 in the accompanying section, which is the upper part of the Old Red Sandstone containing the yellow beds:—



Section across Kenmare Valley, half a mile west of Kilgarvan, on the scale, both vertical and horizontal, of two inches to one mile.

a. Road.	4. Lower Limestone.
b. Road.	3. Carboniferous Slate.
c. Roughty river.	2. Yellow Sandstone.
d. Glebe-house.	1. Old Red Sandstone.
e. Kenmare road.	
f. Stream.	
g. Owbeg river.	
h. New road.	

I shall now draw your attention to the ground north and north-west of Kilgarvan, through which this section is drawn. It is drawn from Carrigagreenane Hill, about two miles and a half north-west of Kilgarvan, to a stream south of Carrignagown Hill, about two miles south-west of Kilgarvan. I shall commence at the river Roughty, and notice the rocks seen in the section to the northern end. We see, first, this band of limestone forming a band along the northern side of the river Roughty; the dip of the beds seem to be south from the road to Kenmare, where a junction is seen between the limestone and the black slates and shales beneath. Passing from thence, we cross over a low, undulating country, formed by these contortions in the limestone and the rocks immediately beneath them, till we come to this last undulation, in which the limestone is seen to dip south at the Owbeg river, from thence we have an almost unbroken section of rocks seen up the Owbeg river to Carrigagreenane, the northern end. Commencing at the limestone at the Owbeg river, we find, in descending order, the following thickness of rocks:—First, about 200 feet of blue and gray crystalline limestone; then about 120 feet of blue and black shales and slates, the upper portion being very calcareous or fossiliferous; again, about 100 feet of gray and yellowish-gray grits, with gray gritty slates; then about 3000 feet of dark purple slates and grits, alternating evenly, grits predominating; then about 1800 feet of greenish-gray grits and slate bands, with thin bands of purple slate and conglomerates in the lower beds, pebbles of white quartz and jasper being common; beneath these again we have about 1400 feet here; but the thickness of these beds is much greater, as on the southern side of the section, where they average· 2100 feet; then we have here a tolerably clear section from the limestone at the Owbeg river, where we start from carboniferous limestone, to Carrigagreenane, two miles up northwards, showing a total thickness of 6200 feet of rocks, which seem to be all conformable to the limestone. This section can be checked over and over again north-eastwards and westwards, and will be found to coincide with the others in making this thickness; and I do not think this to be the total thickness of the rocks beneath the limestone in this district, for further south towards Slugmuffe Hills I found these lower beds of greenish-gray grits to have beneath them again another band of purple slates and grits; but the rocks are so much contorted, that the same beds recur and dip again into Bantry Bay.

The Rev. Professor Haughton said the survey of Mr. Willson had been made in the same district which had been visited by him some years ago, and that his sections, which had been published in the Journal of the Society, were somewhat less detailed, in consequence of his survey having been made more in reference to the metallurgical character of the district. He had found that the copper was all confined to the slate, and the lead to the limestone formation; but in every case the lodes coincided with the strike of the strata, as also with the dip. In this they were similar to the Mansfield mines, which were worked like beds of coal, the copper being found in horizontal beds instead of in fissures and cracks, as was usually the case. He did not think these copper beds were ever likely to prove remunerative in an industrial point of view, but to a geologist they were highly interesting, and they were much indebted to Mr. Willson for his valuable paper.

Captain C. P. Molony, Madras Army, then read the following notice of—

THE OCCURRENCE OF DRIFT COAL IN SAND NEAR NEWCASTLE.

During a tour in search of geological information, that I made last summer in England, I visited, amongst other places, Durham, near Newcastle-on-Tyne. About a mile and a half from the town is a famous coal-pit, called Old Durham, which I went to see. On leaving it, happening to inquire the shortest way back to Durham, I was told to take a road leading through a wood, on the bank of the river, that was pointed out to me a short distance off. The wood lies on the side of a low hill that runs down to the water's edge. In the cuttings made to form the road appeared several very thin beds of coal, which at first were not more than a quarter of an inch thick; but further on, the road winding down the hill, and the cutting becoming deeper, fresh beds, thicker than those first seen, were exposed to view, two of which are each from 12 to 14 inches deep. On examining the beds and digging out part of them, I found them to be made up of sand and round pieces of coal, so unlike in that respect the coal of our coal-pits, that I concluded that I had met with drift coal. I took several pieces from different beds, and all showed marks of having travelled from a distance. All the beds are in a yellowish buff-coloured sand; and immediately above this sand, where the two thick beds are seen, occurs what is commonly called drift, with round stones in it, as large as a child's head. [Captain Molony exhibited a rough sketch, taken from memory, and said]—I regret I had not more time at command to enable me to give a minuter and more satisfactory representation of them, as I had only paid a flying visit to Durham, and was obliged to hurry back to the station to catch the train that was to take me on to Edinburgh that night. These beds are, to all appearance, perfectly parallel, and you will perceive that the several specimens taken from them, which I place before the meeting, are rounded on the edges, and bear every appearance of being drift matter. Having never heard or read in any book on geology, of drift coal that had actually been seen—for I deny that beds containing minute stems and delicate leaves are drift coal—I am anxious to bring the occurrence of these beds before the meeting, in hopes that some member more talented and better acquainted with geology than myself may find an opportunity some day of visiting the place and favouring us with his views on the subject. I beg you will not suppose that I attempt in any way to disprove the theory of our coal-hills being formed of vegetable matter that grew on the spot where it now lies. Such is not my intention, for I believe in that theory myself, and bring forward this drift coal as a proof that the coal we burn is not drift coal. The proofs I adduce in support of this being drift coal are these:—Its being found in pieces, and not in a continuous mass or bed; the rolled appearance of these pieces; and the spaces between them being filled up with sand; and, lastly, the absence in the beds of any trace of the fossil organic remains usually found in coal-beds, such as Sigillaria, Stigmaria, &c., &c.; in fact, that they are the denudation of a bed of coal already formed, but, unlike their parent bed, they contain neither leaves, stems, nor roots.

Mr. Kelly observed that at Lough Erne, and other places, lumps of coal were frequently found before getting down to the cutting. It was possible that ice might have been concerned in the transport of these fragments.

The Rev. Dr. Lloyd, S.F.T.C.D., exhibited a photograph of one of the lunar mountains, taken from a drawing by Father Secchi, of Rome, of "Copernicus," one of the most interesting of these mountains. At the meeting of the British Association in Belfast, a committee was formed for the purpose of considering the appearance of the moon in relation to the geology of the earth, and it was thought advisable that certain portions of its physical structure should be very carefully examined, and compared with corresponding elevations on the surface of the globe. It was with the view of aiding the Committee in their labours that photographs had been taken of this celebrated drawing, which appeared to be very elaborate. The distribution of the lines of elevation was very systematic and regular, and the smaller craters surrounding the great one, which was of a reticulated structure, were very curiously marked. It seemed as if large rocks had been shot out of the larger orifice.

WEDNESDAY EVENING, JANUARY 14, 1857.

The President, LORD TALBOT DE MALAHIDE, in the Chair.

THE following noblemen and gentlemen were admitted as Members:— 1. Lord Bandon, Castle Bernard, county of Cork; 2. Charles Farran, Esq., M. D., Lower Mount-street; 3. Rev. James M'Ivor, Ardstraw Glebe, county of Tyrone; 4. Marcus Keane, Esq., Beech Park, Ennis.

A resolution was passed unanimously, allowing the President to be elected for five years in succession, instead of only two years, as at present.

Professor HAUGHTON then read the following paper:—

ON THE PITCHSTONE AND PITCHSTONE PORPHYRY OF BARNESMORE AND LOUGH ESKE, COUNTY OF DONEGAL.

DURING a visit to the county of Donegal in the summer of 1856, I observed a remarkable series of dykes of felspathic trap and porphyry intersecting the granite of Barnesmore Gap, exhibiting occasionally a tendency to pass into a description of glossy pitchstone. Subsequently I was favoured by James Wood, Esq., of Castlegrove, with some specimens from the mountains beyond Lough Eske, in the same locality, which are genuine pitchstone, passing into amygdaloidal, or rather oolitic porphyry, the cavities being filled with a white mineral which I consider to be Stilbite. As the locality is a new one for pitchstone, and the mineralogical composition of the rock unusual, I thought it might not be uninteresting to place on record its analysis, and the result of my discussion of that analysis.

Analysis of Pitchstone from Lough Eske, county of Donegal.

	Per-centage.	Atoms.	
Silica,	64·04	1·423	
Alumina,	10·40	0·204	0·308
Peroxide of iron,	9·36	0·104	
Lime,	4·24	0·151	0·322
Magnesia,	none	...	
Potash,	3·63	0·077	
Soda,	2·91	0·094	
Loss by ignition,	5·13	0·570	
	99·71		

Assuming this rock to be composed of quartz, felspar, and stilbite, and writing Q, F, S for the number of atoms of each mineral respectively, we find, since—

$$\text{Quartz} = \text{Si O}^3,$$
$$\text{Felspar} = \text{RO, Si O}^3 + \text{R}^2\text{ O}^3,\ 3\text{Si O}^3,$$
$$\text{Stilbite} = \text{RO, Si O}^3 + \text{R}^2\text{ O}^3,\ 3\text{Si O}^3 + 6\text{HO},$$
$$Q + 4F + 4S = 1{\cdot}423,$$
$$F + S = 0{\cdot}315,$$
$$6S = 0{\cdot}570.$$

From these equations we obtain readily,

$$Q = 0{\cdot}163,$$
$$F = 0{\cdot}220,$$
$$S = 0{\cdot}095.$$

If we take 314 for the atomic weight of stilbite, which accords with its usual composition, we find the following—

Mineralogical Composition.

Quartz, ...	7·33
Felspar, ...	62·55
Stilbite, ...	29·83
	99·71

It would be very desirable that an investigation similar to the foregoing were made into the composition of the different varieties of the vast and heterogeneous family of trap rocks. The nomenclature of this class of rocks is a reproach to geological science; and no satisfactory classification can ever be made of these rocks which is not based on their chemical and mineralogical, as well as on their physical properties. Why should not such a body as the British Association undertake the task of reducing to order at least the British varieties of igneous rocks? The funds requisite for the investigation could easily be procured, and the zeal of the members of the Association would supply specimens from every locality of interest: and certainly an authorized nomenclature of igneous rocks proceeding from such a source would carry with it a weight which would go far to establish uniformity of language and precision of ideas on this important, but neglected, subject among British geologists.

Let us take, for an example, the term clinkstone. This is a name given from a physical property common to it with many other rocks, including even limestones. The term was one formed in the infancy of geology, and has come to be used in a sense much more restricted than its original application; it now signifies a fine-grained felspathic rock, of conchoidal fracture, generally of a grayish colour, and containing zeolites as well as felspar. This is the correct meaning of the term clinkstone; and yet it is constantly applied to rocks which contain no zeolites, and some of which are not even of eruptive origin. This confusion as to the meaning of the term has led to the use of various synonyms, or *quasi* synonyms, of which it is sufficient to mention felspathic trap, hornstone, and felstone—the latter recently revived very usefully by the Government geological surveyors. Why should not all these terms, if retained at all, be used in definite senses? The republic of geologists is small, and many of its citizens are well educated; surely there could be no great difficulty in getting them all to use the same language.

At the conclusion of Mr. Haughton's paper, Mr. Kelly commenced the reading of his paper on the "Subdivisions of the Carboniferous Formation in Ireland." The concluding portion of Mr. Kelly's paper was deferred until the second Wednesday in March.

AT THE

ANNUAL GENERAL MEETING

HELD ON

WEDNESDAY, FEBRUARY 11, 1857,

REV. HUMPHREY LLOYD, D.D.,

IN THE CHAIR,

The following Report from the Council was read and adopted :—

YOUR Council offers, as usual, the list of Members at present on the books of the Society, with the corresponding list of last year, showing that the present number of members is 164; while the number last year was 165.

	Jan. 31, 1857.	Jan. 31, 1856.
Honorary Members, ...	4	5
Corresponding Members, ...	3	4
Resident Life Members, ...	17	15
Non-resident Life Members, ...	34	28
Annual Members, ...	85	82
Associates, ...	21	31
	164	165

From this comparison it appears that we have lost one of our Honorary Members, viz., the Very Rev. Dean Buckland; and one Corresponding Member, viz., John S. Kennedy, Esq., C.E., who had been recently appointed to a geological post in India, and died on his way to Singapore to recruit his health; we have also lost ten Associates, in consequence of their having graduated in this University, or left Dublin. On the other hand, we have gained eight Life Members and three Annual Members, as compared with last year's list. On the whole, the position of the Society appears to be very satisfactory, so far as numbers are concerned, for the loss has principally fallen on those members—Honorary, Corresponding, and Associate—who contribute little towards the funds of the Society; while our gain has been in Life and Annual Members, who contribute most to the pecuniary welfare of our body.

Your Council have succeeded, by the aid of the sale of £50 stock, in paying off all the debts which have so long impeded the progress of our

affairs; and believe that, in a financial point of view, we are now in a better position than we have been for many years, as the current expenditure is now placed on a scale strictly commensurate with the yearly income; and your Council confidently expect to make each year's income in future pay the whole of the current expenses of the year.

The Council were enabled to bring about this satisfactory state of things by means of their agreement, as to printing, with the Editor of the "Natural History Review," which enabled them, in conjunction with the liberal grant of £25 from the Board of Trinity College, to print, during 1856, the large amount of 180 pages of your "Journal," at a cost to the Society of only £30.

Your Council have made a new agreement with the "Natural History Review," for the year 1857, by which the Society will obtain 250 copies of 128 pages, for the sum of £25. This amount of printing in the "Journal" will meet all the wants of the Society, and we shall obtain the advantage of the additional circulation of 500 copies of the "Review" for our papers, which your Council believe are looked upon as interesting and valuable by an increasing circle of readers.

Among the Annual Members lost to the Society, your Council has to deplore the loss, by death, of Mr. Richard Hitchcock, who had served the Society well and faithfully for many years. The Council has appointed Mr. Blackwood to succeed him—an appointment which they have reason to believe will give satisfaction to the Society.

A change was proposed in the organic laws of the Society by the Council, which was sanctioned at the January meeting by the Society, to the effect that the President may, in future, be elected *five* times in succession, instead of *twice*, which was formerly the rule of the Society. It is hoped that this change will work well for the Society.

The Appendix which accompanies this Report contains full information relative to the names of the 164 members at present on the books of the Society; the list of Societies entitled to receive the "Journal of the Geological Society of Dublin;" the names of the members gained and lost during the year; the donations made to the Society; and the audited accounts of the Society to the 31st December, 1856,—from which latter it appears that the Society is in the Treasurer's debt to the small amount of £4 19*s*. 2*d*.

February 11, 1857. H. Lloyd, *Chairman*.

APPENDIX TO ANNUAL REPORT.

No. I.

LIST OF MEMBERS, CORRECTED TO JANUARY 31, 1857.

Members are requested to correct errors in this List, by letter to the REV. SAMUEL HAUGHTON, *Trinity College, Dublin.*

HONORARY MEMBERS.

Elected.

1844. 1. Bouè, Amie, F. G. S., *Paris.*

1844. 2. Lyell, Sir Charles, F. R. S., 11, *Harley-street, London.*

1844. 3. Murchison, Sir Roderick J., G. C. St. G., F. R. S., H. M. R. I. A., 16, *Belgrave-square, London.*

1832. 4. Sedgwick, Rev. A., M. A., F. R. S., *Cambridge.*

HONORARY CORRESPONDING MEMBERS.

1854. 1. Thomas Oldham, Esq., F. R. S., *India.*

1854. 2. Arthur A. Jacob, Esq., C. E., *India.*

1855. 3. Joseph Medlicott, Esq., *India.*

LIFE MEMBERS.

1853. 1. Allen, Richard Purdy, Esq., 22, *Blackhall-place.*

1832. 2. Davis, Charles, Esq., M. D., M. R. I. A., 33, *York-street.*

1831. 3. Hamilton, Sir W. R., M. R. I. A., *Observatory, Dunsink.*

1848. 4. Haughton, Rev. Professor, F. G. S., 40, *Trinity College.*

1850. 5. Hone, Nathaniel, Esq., M. R. I. A., *St. Doulough's, Co. Dublin.*

1831. 6. Hutton, Robert, Esq., M.R. I. A., F. G. S., *Putney Park, London.*

1853. 7. Harkness, Professor, F. G. S., *Queen's College, Cork.*

1857. 8. Haliday, A. H., Esq., M. R. I. A., *Harcourt-street.*

1851. 9. Jukes, Joseph Beete, A. M., F. R. S., M. R. I. A., 51, *Stephen's-green.*

1835. 10. Kelly, John, Esq., 51, *Stephen's-green.*

1834. 11. King, Hon. James, M. R. I. A., *Mitchelstown.*

1848. 12. Luby, Rev. Thomas, D. D., M. R. I. A., *Trinity College.*

1851. 13. Malahide, Lord Talbot de, *Malahide Court, Malahide.*

1846. 14. Murray, B. B., Esq., 69, *Lower Gardiner-street.*

1851. 15. Whitty, John Irvine, Esq., LL. D., 1, *Henrietta-street.*

1854. 16. Wyley, Andrew, Esq., 51, *Stephen's-green.*

1846. 17. Willson, Walter, Esq., 51, *Stephen's-green.*

NON-RESIDENT LIFE MEMBERS.

Elected.

1831. 1. Baillie, Rev. James Kennedy, D. D., M. R. I. A., *Ardtrea, Stewartstown.*
1854. 2. Barnes, Edward, Esq., *Ballymurtagh, Co. Wicklow.*
1832. 3. Bryce, James, Esq., *High School, Glasgow.*
1854. 4. Clemes, John, Esq., 80, *Lower Ormond-quay.*
1855. 5. Carter, Sampson, Esq., C. E., *Kilkenny.*
1856. 6. Du Noyer, G. V., Esq., 51, *Stephen's-green.*
1832. 7. Dunraven, Lord, 20, *Merrion-square, North.*
1836. 8. Enniskillen, Earl of, M. R. I. A., *Florence Court, Enniskillen.*
1844. 9. Esmonde, Sir Thomas, Bart., M. R. I. A., 9, *Great Denmark-street.*
1854. 10. Foote, Frederick J., Esq., 51, *Stephen's-green.*
1856. 11. Haughton, Lieut. John, R. A., *St. Helena.*
1840. 12. Jackson, James E., Esq., *Tulliderry, Blackwatertown.*
1839. 13. James, Colonel, R. E., F. R. S., M. R. I. A., *Ordnance Survey Office, Southampton.*
1832. 14. Kearney, Thomas, Esq., *Pallas-green, Co. Limerick.*
1857. 15. Keane, Marcus, Esq., *Beech Park, Ennis, Co. Clare.*
1839. 16. Lansdowne, Marquis of, 54, *Berkeley-square, London.*
1838. 17. Larcom, Lieut.-Col., R. E., LL. D., F. R. S., M. R. I. A., *Phœnix Park.*
1840. 18. Lindsay, Henry L., C. E., 31, *Blessington-street.*
1832. 19. Mac Adam, James, Esq., F. G. S., 18, *College-street, East, Belfast.*
1840. 20. Montgomery, James E., Esq., *Fermanagh.*
1856. 21. Molony, C. P., Captain, 29, *Holles-street.*
1856. 22. Medlicott, Henry, Esq., *Roarkee, Bombay.*
1857. 23. M'Ivor, Rev. James, *Rectory, Moyle, Newtownstewart, Co. Tyrone.*
1845. 24. Neville, John, Esq., C. E., M. R. I. A., *Dundalk.*
1852. 25. O'Kelly, Joseph, Esq., 51, *Stephen's-green.*
1844. 26. Palmerston, Viscount, G. C. B., M. P., 4, *Carlton Gardens, London.*
1852. 27. Portlock, Lieut.-Col., R. E., F. R. S., M. R. I. A., *Archcliffe Fort, Dover.*
1832. 28. Renny, Henry L., R. E., M. R. I. A., *Finglas.*
1835. 29. Saunderson, Alexander, Esq., *Castle Saunderson, Co. Cavan.*
1854. 30. Smyth, W. W., Esq., *Jermyn-street, London.*
1832. 31. Tighe, Right Hon. William, *Woodstock, Innistiogue.*
1834. 32. Verschoyle, Archdeacon, *Rathbarron, Collooney.*
1853. 33. Webster, William B., Esq., 104, *Grafton-street.*
1857. 34. Wynne, Arthur B., Esq., 51, *Stephen's-green.*

ANNUAL MEMBERS.

1831. 1. Apjohn, James, Esq., M. D., F. R. S., M. R. I. A., 32, *Lower Baggot-street.*
1854. 2. Ashton, Samuel, Esq., *Woodfield, Newtownbarry.*
1835. 3. Ball, Robert, Esq., LL. D., M. R. I. A., 3, *Granby-row.*

Elected.

1854. 4. Banks, John G., Esq., M. D., 29, *Upper Merrion-street.*
1844. 5. Bective, Earl of, *Headford, Kells.*
1855. 6. Barton, H. M., Esq., *Stonehouse, Donnybrook.*
1855. 7. Byrne, Griffin, Esq., 14, *Westland-row.*
1844. 8. Byrne, Patrick, Esq., 27, *Talbot-street.*
1831. 9. Brady, Right Hon. Lord Chancellor, M. R. I. A., 26, *Upper Pembroke-st.*
1857. 10. Bandon, Right Hon. Lord, *Castle Bernard, Co. Cork.*
1840. 11. Callwell, Robert, Esq., M. R. I. A., 25, *Herbert-place.*
1834. 12. Croker, Charles P., M. D., M. R. I. A., 7, *Merrion-square, West.*
1855. 13. Clarke, Edward, Esq., M. D., *National School, Limerick.*
1832. 14. Curran, W. H., Esq., 9, *Fitzwilliam-place.*
1853. 15. Clarke, William F., Esq., *Claremont, Glasnevin.*
1846. 16. D'Arcy, Matthew, Esq., M. R. I. A., *Anchor Brewery, Usher-street.*
1849. 17. Dawson, William, Esq., 11, *Mountjoy-square, East.*
1855. 18. Domville, C. H., Esq., 41, *Lower Gardiner-street.*
1849. 19. Downing, Samuel, Esq., C. E., 6, *Trinity College.*
1839. 20. Duncan, James, Esq., M. D., *Farnham House, Finglas.*
1852. 21. Doyle, J. B., Esq., *Martello-terrace, Sandymount.*
1853. 22. De Vesci, Lord, *Abbeyleix House, Abbeyleix.*
1853. 23. England, Professor, *Queen's College, Cork.*
1856. 24. Flemming, Lionel J., Esq., C. E., 2, *Henrietta-street.*
1853. 25. Flanagan, Stephen W., Esq., *Fitzwilliam-place.*
1857. 26. Farran, Charles, Esq., M. D., 9, *Lower Mount-street.*
1843. 27. Fitzwilliam, Earl of, F. R. S., F. S. A., *Mortimer House, Halkin-street, London.*
1849. 28. Galbraith, Rev. Joseph A., F. T. C. D., M. R. I. A., 8, *Trinity College.*
1856. 29. Ganley, Patrick, Esq., 78, *Capel-street.*
1849. 30. Gyles, A. M'Gwire, Esq., *Saunders' Court, Kyle, Enniscorthy.*
1853. 31. Geoghegan, Henry, Jun., Esq., 41, *Rathmines-road.*
1831. 32. Griffith, Richard, LL. D., M. R. I. A., F. G. S., 2, *Fitzwilliam-place.*
1852. 33. Gordon, Samuel, M. D., M. R. I. A., 11, *Hume-street.*
1856. 34. Good, John, Esq., *City-quay.*
1831. 35. Hamilton, Charles W., Esq., M. R. I. A., 40, *Lower Dominick-street.*
1850. 36. Head, Henry, Esq., M. D., M. R. I. A., 28, *Upper Mount-street.*
1832. 37. Harrison, Robert, Esq., M. D., M. R. I. A., 1, *Hume-street.*
1848. 38. Harvey, Professor, M. D., M. R. I. A., 40, *Trinity College.*
1834. 39. Hutton, Thomas, Esq., M. R. I. A., F. G. S., 116, *Summer-hill.*
1853. 40. Hemans, George W., C. E., M. R. I. A., 10, *Rutland-square, East.*
1852. 41. Jellett, Rev. Professor, F. T. C. D., M. R. I. A., 6, *Trinity College.*
1842. 42. Jennings, T. W., Esq., M. R. I. A., F. G. S., *Brown-street, Cork.*
1855. 43. Kavanagh, J. W., Esq., *Apsley House, Rathmines.*
1855. 44. Kingsmill, Thomas W., Esq., 97, *Lower Mount-street.*

Elected.

1856. 45. **Kinahan, John R., Esq., M. B.,** ***Seafield-terrace, Donnybrook.***
1853. 46. **Kinahan, George H., Esq.,** ***Seafield-terrace, Donnybrook.***
1853. 47. **Kingsmill, Henry, Jun., Esq., 97,** ***Lower Mount-street.***
1853. 48. **Kirwan, John Stratford, Esq., 15,** ***Merrion-square.***
1854. 49. **Locke, John, Esq., 2,** ***Kensington-place, Rathmines.***
1831. 50. **Lloyd, Rev. Humphrey, D. D., M. R. I. A., 85,** ***Trinity College.***
1854. 51. **Longfield, Rev. George, F. T. C. D.,** ***Trinity College.***
1856. 52. **Lentaigne, John, Esq., M. D.,** ***Great Denmark-street.***
1855. 53. **M'Causland, Dominick, Esq., 12,** ***Fitzgibbon-street.***
1831. 54. **M'Donnell, John, Esq., M. D., M. R. I. A., 4,** ***Gardiner's-row.***
1852. 55. **Mac Donnell, Rev. Richard, D. D., M. R. I. A., Provost of Trinity College, Dublin,** ***Provost's House, Trinity College.***
1838. 56. **Mallet, Robert, Esq., C. E., M. R. I. A., F. G. S.,** ***Delville, Glasnevin.***
1849. 57. **Maguire, Thomas, Esq., 34,** ***Upper Dominick-street.***
1837. 58. **Mollan, John, Esq., M. D., M. R. I. A., 8,** ***Fitzwilliam-square, North.***
1851. 59. **M'Dowell, George, F. T. C. D., 6,** ***Trinity College.***
1854. 60. **M'Arthur, Alexander, Esq.,** ***Booterstown.***
1853. 61. **M'Cartney, George, Esq.,** ***Lowther Lodge, Balbriggan.***
1856. 62. **M'Guire, Joseph, Esq., C. E.,** ***Kenilworth-square, Rathgar.***
1831. 63. **Nicholson, John, Esq., M. R. I. A.,** ***Balrath House, Kells.***
1856. 64. **O'Brien, Octavius, Esq., 23,** ***Kildare-street.***
1832. 65. **Patten, John, Esq.,** ***Royal Dublin Society.***
1843. 66. **Petherick, John, Esq.,** ***Knockmahon, Kilmacthomas.***
1852. 67. **Pigot, Right Hon. Chief Baron, M. R. I. A., 52,** ***Stephen's-green.***
1856. 68. **Robinson, Hartstong, Esq., 15,** ***St. James's-terrace, Rathmines.***
1849. 69. **Rowan, Archdeacon, A. M., M. R. I. A.,** ***Belmont, Tralee.***
1852. 70. **Smith, Robert, M. D., M. R. I. A., 63,** ***Eccles-street.***
1852. 71. **Sanders, Gilbert, Esq., M. R. I. A., 2,** ***Foster-place.***
1854. 72. **Scott, Robert H., Esq., 2,** ***Trinity College.***
1844. 73. **Shirley, Evelyn J., Esq.,** ***Loughfew, Carrickmacross.***
1849. 74. **Sidney, F. J., LL. D., M. R. I. A., 19,** ***Herbert-street.***
1856. 75. **Salter, J. W., Esq.,** ***Museum of Practical Geology, Jermyn-street, London.***
1853. 76. **Scott, William, Esq., 6,** ***Leinster-street.***
1832. 77. **Wall, Rev. C. W., D. D., M. R. I. A., 20,** ***Trinity College.***
1844. 78. **Welland, Joseph, 48,** ***Upper Rutland-street.***
1836. 79. **Worrall, John, Esq., C. E., 202,** ***Great Brunswick-street.***
1855. 80. **Willis, Hamilton, Esq.,** ***Ballycorus Lead Works, Golden Ball.***
1849. 81. **Willock, Rev. William A., F. T. C. D.,** ***Cleenish Rectory, Enniskillen.***
1851. 82. **Wright, Edward, Esq., LL.D., 43,** ***Dame-street.***
1839. 83. **Wynne, Right Hon. John, M. R. I. A.,** ***Hazlewood, Co. Sligo.***
1833. 84. **Wilson, Robert M., Esq.,** ***Larkhill, Rathmines.***
1843. 85. **Yeates, George, Esq., M. R. I. A., 2,** ***Grafton-street.***

ASSOCIATES.

1855. 1. Brownrigg, W. B., Esq., *Adelaide-road.*
1856. 2. Babington, W. D., Esq., *Roebuck, Dundrum.*
1854. 3. Cochrane, D. C., Esq., 12, *Lower Mountpleasant-avenue.*
1855. 4. Fisher, John W., Esq., 18, *Trinity College.*
1856. 5. Green, S. N., Esq., 170, *Great Brunswick-street.*
1853. 6. Grainger, John, Esq., *University Museum.*
1855. 7. Gwynne, Robert, Esq., 18, *Trinity College.*
1855. 8. Geoghegan, Jacob H., Esq., 41, *Rathmines-road.*
1855. 9. Hewson, Francis, Esq., *Fortfield, Roundtown,*
1855. 10. Johnston, Alexander, Esq., 28, *Trinity College.*
1856. 11. Martin, Charles, Esq., 38, *Trinity College.*
1854. 12. Maguire, John James, Esq., 40, *Lower Dominick-street.*
1855. 13. Richardson, John, Esq., 9, *Trinity College.*
1856. 14. Townsend, Edward, Esq., 33, *Trinity College.*
1855. 15. Waller, Arthur, Esq., 1, *James's-gate.*
1853. 16. Wright, E. Percival, *Flora Ville, Donnybrook.*
1856. 17. Warren, James, Esq., 39, *Rutland-square.*
1856. 18. Galway, William, Esq., 11, *Trinity College.*
1856. 19. Griffith, James, Esq., 2, *Rathmines-road.*
1853. 20. Kincaid, Joseph, Jun., Esq., 3, *Herbert-street.*
1856. 21. Martin, Thomas, Esq., 38, *Trinity College.*

PRESENT STATE OF SOCIETY.

Honorary Members, ...	4
Honorary Corresponding Members, . . .	3
Life Members, ...	51
Annual Members, ...	85
Associates, ...	21
	164

No. II.

SOCIETIES AND INSTITUTIONS ENTITLED TO RECEIVE THE JOURNAL OF THE GEOLOGICAL SOCIETY OF DUBLIN.

ABERDEEN, . University Library.
BELFAST, . . Natural History Society.
Queen's College Library.
BRISTOL, . . Philosophical Society.
CAMBRIDGE, . Philosophical Society.
University Library.

CORK, . . .	Queen's College Library.
	Royal Institution.
	Cuvierian Society.
DUBLIN, . .	Royal Irish Academy.
	University Library.
	Royal Dublin Society.
	Natural History Society.
	Ordnance Survey Library.
	Geological Survey of Ireland.
	University Philosophical Society.
	University Zoological and Botanical Association.
EDINBURGH, .	Royal Society.
	Wernerian Society.
	Society of Arts.
	University Library.
GALWAY, . .	Queen's College Library.
KILKENNY, .	Archæological Society.
LEEDS, . .	Geological and Polytechnic Society of the West Riding of Yorkshire.
LIVERPOOL, .	The Literary and Philosophical Society.
	Historic Society of Lancashire and Cheshire.
LONDON, . .	Geological Survey, *Jermyn-street.*
	British Museum.
	Society of Arts, *John-street*, *Adelphi.*
	Royal Society, *Somerset House.*
	Royal Institution, *Albemarle-street.*
	Geological Society, *Somerset House.*
	Linnean Society, *Soho-square.*
	Geographical Society, 6, *Charing Cross.*
	Civil Engineers' Institute, 25, *Great George's-street*, *Westminster.*
	Royal Asiatic Society.
	Zoological Society.
	Athenæum.
	Literary Gazette.
	The Hon. the East India Company, *East India House.*
MANCHESTER,	Geological Society.
	Institute.
OXFORD, . .	Bodleian Library.
	Ashmolean Society.
ST. ANDREW'S,	University Library.
FOREIGN, . .	The Editors of Silliman's Journal of Science and Art, *New York.*
	Natural History Society, *Boston.*
	Smithsonian Institute Library.
	Canadian Institute.

No. III.

MEMBERS ADDED.

Life Members.

G. V. Du Noyer, Esq.
Alexander H. Haliday, Esq.
Marcus Keane, Esq.
Captain Molony, Madras Army.
Rev. James M'Ivor.
Arthur B. Wynne, Esq.
H. B. Medlicott, Esq.

Annual Members.

Right Hon. Lord Bandon.
Charles Farran, Esq., M. D.
Lionel Flemming, Esq.
John Good, Esq.
Patrick Ganley, Esq.
J. R. Kinahan, Esq., M. B.
Joseph Maguire, Esq.
Octavius O'Brien, Esq.
H. Robinson, Esq.
J. W. Salter, Esq.
John Worrall, Esq.
John Lentaigne, Esq., M. D.

Associates.

W. D. Babington, Esq.
William Galway, Esq.
S. N. Green, Esq.
James Griffith, Esq.
Thomas Martin, Esq.
Charles Martin, Esq.
Edward Townsend, Esq.
James Warren, Esq

LOST FROM DEATH AND OTHER CAUSES.

Honorary Member.

Very Rev. W. Buckland.

Honorary Corresponding Member.

John L. Kennedy, Esq.

Annual Members.

Francis Codd, Esq.
Patrick Fenlon, Esq.
B. D. Gibbons, Esq.
Richard Hitchcock, Esq.
John Moore, Esq.
William Mulvany, Esq.
Alexander M'Mullen, Esq.
M. O'Grady, Esq.
John Purser, Esq.

Associates.

John Alexander, Esq.
R. Barton, Esq., C. E.
H. D. Crozier, Esq., R. E.
Charles Colton, Esq., C. E.
Edward Crofton, Esq.
J. Hime, Esq., C. E.
W. E. Hamilton, Esq.
D. A. M'Cready, Esq.
Charles Neville, Esq.
W. H. Noble, Esq., R. A.
T. Nolan, Esq.
Wilton Oldham, Esq.
Thaddeus O'Mahony, Esq.
Jones Pigott, Esq.
G. K. Reid, Esq.
Robert C. Smith, Esq., R. A.
R. Stewart, Esq.

Total added, ...	27
Total lost, ...	28
Lost, ...	1

No. IV.

DONATIONS RECEIVED DURING THE YEAR 1856-7.

1856.

Feb. 25.—Proceedings of the Ashmolean Society, 1855. Presented by the Society.

Feb. 28.—American Journal of Science and Arts, No. 61. Presented by the Editors.

Mar. 4.—Journal of the Proceedings of the Linnean Society, Vol. I., No. 1. Presented by the Society.

Mar. 12.—Journal of the Society of Arts, Nos. 169 to 172. Presented by the Society.

Mar. 12.—The Athenæum and Literary Gazette for February, 1856. Presented by the Editors.

Mar. 12.—Sermons in Stones. By Dominick M'Causland, Esq. Presented by the Author.

Mar. 19.—Proceedings and Papers of the Kilkenny and South-East of Ireland Archæological Society, Vol. I., Part 1, N. S., January, 1856. Presented by the Society.

Mar. 28.—Twenty-first Annual Report of the Board of Directors of the Young Men's Mercantile Library Association of Cincinnati, for the year 1855. Presented by the Association.

Mar. 31.—American Journal of Science and Art, No. 62, March, 1856. Presented by the Editors.

April 9.—Journal of the Society of Arts, Nos. 173 to 176. Presented by the Society.

April 9.—The Athenæum and Literary Gazette for March, 1856. Presented by the Editors.

April 9.—Fifty copies of the Society's Journal, Vol. VII., Part I. Presented by Professor Haughton.

April 16.—The Mining Journal, Nos. 1075 and 1076. Presented by the Editor.

May 14.—Journal of the Society of Arts, Nos. 177 to 181. Presented by the Society.

May 14.—The Athenæum and Literary Gazette, April, 1856. Presented by the Editors.

May 14.—Proceedings of the Royal Geographical Society of London, Nos. 1 and 2. Presented by the Society.

May 14.—Notices of the Meetings of the Members of the Royal Institution of Great Britain, Part V. Presented by the Institution.

May 14.—The Solar and Lunar Diurnal Tides on the Coasts of Ireland. By the Rev. Samuel Haughton, M. A. Presented by the Author.

May 16.—Third Report of the Commissioners for the Exhibition of 1851, to the Right Hon. Sir George Grey, Bart. Presented by the Commissioners.

May 28.—Report of the Twenty-fourth Meeting of the British Association for the Advancement of Science, held at Liverpool, in September, 1854. Presented by the Association.

May 28.—Proceedings and Papers of the Kilkenny and South-East of Ireland Archæological Society, March, 1856. Presented by the Society.

May 31.—The Mining Journal, Nos. 1081, 1083. Presented by the Editor.

May 31.—The Irish Reporter, No. 5. Presented by the Editor.

June 11.—The Athenæum and Literary Gazette, May, 1856. Presented by the Editors.

June 11.—Journal of the Society of Arts, Nos. 182 to 185. Presented by the Society.

June 11.—Journal of the Proceedings of the Linnean Society, Vol. I., No. 2. Presented by the Society.

Nov. 12.—Thirty-fifth and Thirty-sixth Reports of the Council of the Leeds Philosophical and Literary Society, 1854–6. Presented by the Society.

Nov. 12.—Report of the Proceedings of the Geological and Polytechnic Society of the West Riding of Yorkshire, 1844–5 and 1855. Presented by the Society.

Nov. 12.—Transactions of the Historic Society of Lancashire and Cheshire, Vol. VIII., 1856. Presented by the Society.

Nov. 12.—Proceedings of the Linnean Society, Nos. 61 to 66, with the Address of Thomas Bell, Esq., V. P. R. S., President, and a List of the Society, 1855. Presented by the Society.

Nov. 12.—Proceedings of the Royal Geographical Society of London, Nos. 3 to 5. Presented by the Society.

Nov. 12.—Notices of the Meetings of the Members of the Royal Institution of Great Britain, Part VI. Presented by the Institution.

Nov. 12.—Proceedings of the Zoological Society, Nos. 258 to 309. Presented by the Society.

Nov. 12.—Athenæum, June to October, 1856. Presented by the Editor.

Nov. 12.—Literary Gazette, June to October, 1856. Presented by the Editor.

Nov. 12.—Journal of the Society of Arts, Nos. 187 to 207. Presented by the Society.

Nov. 12.—Proceedings of the Literary and Philosophical Society of Liverpool, No. 10. Presented by the Society.

Nov. 12.—The American Journal of Science and Arts, No. 65. Presented by the Editor.

Nov. 12.—Journal of the Proceedings of the Linnean Society, Vol. I., No. 3. Presented by the Society.

Nov. 12.—Quarterly Journal of the Geological Society of London, Nos. 44, 45, 46. Presented by the Society.

Nov. 12.—Address delivered at the Anniversary Meeting of the Geological Society of London, on the 15th of February, 1856, by John William Hamilton, Esq., President of the Society. Presented by the Author.

Nov. 12.—The American Journal of Science and Arts, No. 64. Presented by the Editor.

Nov. 12.—Proceedings and Papers of the Kilkenny and South-East of Ireland Archæological Society, May and July, 1856. Presented by the Society.

Nov. 20.—Proceedings and Papers of the Kilkenny and South-East of Ireland Archæological Society, September, 1856. Presented by the Society.

Nov. 20.—Proceedings of the Academy of Natural Sciences of Philadelphia, January, 1856. Presented by the Academy.

Nov. 20.—List of Foreign Correspondents of the Smithsonian Institution, May, 1856. Presented by the Institution.

Nov. 20.—A Notice of the Origin, Progress, and Present Condition of the Academy of Natural Sciences of Philadelphia. Presented by the Academy.

Nov. 20.—A List of the Council and Officers of the Society for the Encouragement of Arts, Manufactures, and Commerce, London. Presented by the Society.

1857.

Jan. 1.—Memoirs of the Geological Survey. British Organic Remains, Decades 4, 5, 6, and 8. Records of the School of Mines, Parts I. and IV. Report on Devon, by Sir H. De La Beche. Fossils in Devon, by Phillips. Mineral Statistics for 1854–5. The Iron Ores of Great Britain, Part I. Presented by Sir Roderick J. Murchison, from the Museum of Practical Geology and Geological Survey Office.

Jan. 1.—Proceedings and Papers of the Kilkenny and South-East of Ireland Archæological Society, Vol. I., No. 6, New Series, Nov. 1856. Presented by the Society.

Jan. 1.—The Geological Map of Malta and Gozo, engraved from the Survey of the Earl of Ducie and Captain Spratt, R. N. Presented by Lord Panmure, Secretary of State for the War Department, through Lieut-Col. James, R. N.

Jan. 1.—The Geological Map of Ireland (in 6 parts). Presented by R. Griffith, Esq., LL. D.

Jan. 1.—The Journal of the Natural History Society for 1855 and 1856. Presented by the Society.

No. V.

ABSTRACT OF THE TREASURER'S ACCOUNT FOR THE YEAR ENDED DECEMBER 31, 1856.

Dr. 1856.	£	s.	d.	£	s.	d.
To Balance from last year,				28	13	5
— Dividend received on Government Stock,				0	15	0
— Sale of £50 Government Stock,	46	16	3			
— Dividend on above,	1	10	0			
				48	6	3
— Admission Fees,	7	0	0			
— Annual Subscriptions,	69	10	0			
— Life Subscriptions,	35	0	0			
				111	10	0
— Balance due Treasurer,				4	19	2
				£194	3	10

Cr. 1856.	£	s.	d.	£	s.	d.
By One Half-year's Salary to Assistant Secretary,	10	0	0			
— Cash paid for Lithographs, including carriage,	4	8	8			
(per Draft 5145)				14	8	8
— Treasurer, "Natural History Review,"	12	10	0			
— Gratuity to Attendant,	1	10	0			
(per Draft 5146)				14	0	0
— Mr. Gill's Account for Printing (per Draft 5147),				56	0	1
— Ditto, ditto, (per Draft 5148),				45	15	5
— Incidentals, per Assistant Secretary (Draft 5149),				7	7	1
— Editors of "Natural History Review" for One Half-year, to July,				12	10	0
— Salary to Assistant Secretary, to 14th August,	10	0	0			
— Sundries, per Assistant Secretary,	3	7	3			
— Mr. Tallon's Account for Stationery,	1	4	4			
— Mr. Pilkington's Account for Binding,	8	18	4			
— Mr. Oldham's Account for Illustrations,	5	0	0			
(per Draft 10,276),				28	9	11
— Half-year's Salary to Assistant Secretary, to 14th February (per Draft 10,277),				10	0	0
— Paid Commission to Collector for year ending this date	5	8	0			
— Postage and Receipt Stamps, per ditto,	0	4	8			
				5	12	8
				£194	3	10

Accounts examined and found correct, leaving a balance of £4 19*s*. 2*d*. due to the Treasurer, this 4th day of February, 1857,

J. B. DOYLE,
GEO. V. DU NOYER.

The ballot being closed, the following gentlemen were declared duly elected upon the Council for the ensuing year:—

President:

LORD TALBOT DE MALAHIDE.

Vice-Presidents:

1. ROBERT MALLET, C. E., M. R. I. A.
2. EDWARD WRIGHT, LL. D., M. R. I. A.
3. JAMES APJOHN, M. D., M. R. I. A.
4. PROFESSOR HARVEY, M. D., M. R. I. A.
5. REV. HUMPHREY LLOYD, D. D., S. F. T. C. D.

Treasurers:

GILBERT SANDERS, ESQ., M. R. I. A.
F. J. SIDNEY, LL. D., M. R. I. A.

Secretaries:

REV. PROFESSOR HAUGHTON, F. T. C. D.
JOSEPH BEETE JUKES, ESQ., M. R. I. A.

Council:

ROBERT BALL, LL. D.
JOHN MACDONNELL, M. D.
ROBERT CALLWELL, ESQ.
RICHARD GRIFFITH, LL. D.
REV. J. A. GALBRAITH, F. T. C. D.
JOHN KELLY, ESQ.
GEORGE M'DOWELL, F. T. C. D.
SAMUEL DOWNING, LL. D., C. E.
REV. GEORGE LONGFIELD, F. T. C. D.
SAMUEL GORDON, M. D.
JOHN B. DOYLE, ESQ.
DOMINICK M'CAUSLAND, ESQ.
J. R. KINAHAN, M. B.
G. V. DU NOYER, ESQ.
ALEXANDER H. HALIDAY, ESQ., M. R. I. A.

ANNUAL ADDRESS

DELIVERED BEFORE THE

GEOLOGICAL SOCIETY OF DUBLIN,

FEBRUARY 11, 1857,

BY

LORD TALBOT DE MALAHIDE,

PRESIDENT OF THE SOCIETY.

GENTLEMEN,—In reviewing the state of our Society during the past year, although it is satisfactory to find no retrogression, I should have wished to be able to congratulate you on a larger accession of new members. Upon the whole, we have one member less than last year, though, as the loss is principally in Honorary, Corresponding, and Associate Members, we have in reality a gain of nine Ordinary Members. I trust that at the meeting of the British Association in this city steps may be taken to enable us to enlarge the sphere of our operations.

Among the losses we have sustained, that of our Assistant Secretary, Mr. Richard Hitchcock, is much to be deplored. You all know how much we are indebted to his attention to the affairs of our Society, to his punctuality and zeal in carrying out its objects. He was possessed of a very refined mind, and had acquired a very considerable proficiency in various branches of literature, particularly Archæology, with which our science is so nearly allied; and, doubtless, if he had been spared, we might have anticipated receiving many valuable contributions from his pen.

We have also to deplore the loss, by death, of one of our Honorary Corresponding Members, John S. Kennedy, Esq., C.E., who died in India, when on his way to Singapore to recruit his failing health. This gentleman was a gold medallist of the University of Dublin, was subsequently attached to the Irish Geological Survey, and afterwards to that of India, which post, unfortunately, he did not live to enjoy for a length of time sufficient to develop the results which his known zeal and skill in Geology would probably have led to.

Geological science has also to regret the removal by death of the Very Rev. Dean Buckland, to whose exertions the early progress of English Geology was so largely due. His loss is felt wherever the science of Geology is cultivated, and the detailed account of his labours will naturally be given by the President of the Geological Society of London, of which he was so distinguished an ornament.

Our papers continue to be most valuable, and we have during the past year published a larger amount of them than any previous year, owing to the liberality of the Board of Trinity College, and other reasons which have been adverted to in the Report of the Council. It is not my intention to give a detailed summary of all the papers written by our members and associates; but there are some of so great importance that it is due to the interests of Science not to pass them over in silence. In the first place, our thanks are due to the patriarch of Irish Geology, Dr. Griffith, for the new edition of his "Irish Geological Map," which has just issued from the press. It would be presumption on my part to attempt an eulogium on this great work, now in the possession of an European reputation.

Mr. Kelly's paper on the Palæozoic Rocks of Ireland is a most valuable one. With his accuracy and perseverance, great light must be thrown on the relations of these difficult rocks. He states that the Irish Old Red Sandstone is distinct from the Brownstone of the south (which is, according to him, a member of the Silurian formation), and that it is found always uncomformable to these underlying strata, but conformable to the coal-measures above. The conclusions he draws, both from stratigraphical grounds and from a comparison of the fossils contained in it, are, that it is an integral part of the Carboniferous System, and does not, as contended by Sir Charles Lyell, with regard to the British Devonian rocks, constitute a passage or gradual change from the Silurian to the Carboniferous System, and partake of the nature of both in fossils as well as rocks. Mr. Haughton's paper on the Lower Carboniferous Beds of the Peninsula of Hook, in the county of Wexford, strongly confirms Mr. Kelly's views. This is one of the most important questions affecting Irish Geology, and one to which I request your continued and earnest attention.

Dr. Kinahan has added considerably to our knowledge of the organic remains contained in the Cambrian strata by his observations on the Rocks of Bray Head, where he has discovered the traces or burrows of some annelidan borer. This discovery is particularly interesting, as these tracks are associated with the Oldhamia, which are found most abundantly both above and below them. With this subject is most closely connected the paper of Mr. Salter, who, in the Proceedings of the London Geological Society, describes various fossils which have been found by him in the Longmynd rocks of Shropshire. They consist of:—

1. Markings resembling the holes of marine worms. They are very numerous, and are always parallel in pairs; also tracks of worms.

2. A new kind of Trilobite, by him named *Palæopyge Ramsayi*. This appears tolerably well defined, and is the most interesting Cambrian fossil yet discovered. He also found marks strongly resembling rain-drops and ripple-marks, which point out to littoral action and exposure to the atmosphere. These discoveries form a new era in the history of the Cambrian formation.

There is also another subject which has been treated with his usual ability by our Secretary, Mr. Haughton; and, although the detailed results have been communicated directly to the London Society, they are so important, and the manner in which he has conducted this latterly much neglected branch of inquiry, *Mineralogical Geology*, reflects so much credit on our Society, that I am sure you will be glad to hear some of the conclusions to which his analysis leads. The title of his paper is—"A Detailed Analysis of the Granites of the S.E. and N.E. of Ireland." From this it appears that—

1. In the S.E. of Ireland the granites may be classified by the preponderance of potash over soda, and *vice versâ*.

2. The granites of the main chain and of Carnsore are potash granites.

3. The granites of the intermediate groups are soda granites, and reducible to two types—

a. The Croghan Kinshela granite.

b. The soda granite proper.

4. The potash and soda granites differ from each other in a regular manner in respect to the other constituents, as well as in respect to the

alkalies,—the most striking difference being the deficiency of silica in the soda granites, this deficiency being made up by the addition of peroxide of iron and lime; and the increase of the specific gravity of the soda granites.

The granites of the N.E. consist of the granites of the Mourne, Carlingford, and Newry districts.

1. The Mourne granite, on being analyzed, shows a striking resemblance to the potash granite of Leinster, except in containing 3 per cent. more quartz. This excess of silica is accompanied by a falling off of the lime and magnesia.

2. The granites of the Carlingford district are of two varieties, both containing a preponderance of potash. The first variety is very like in composition to that of the main chain of Leinster. The second is quite different, both physically and mineralogically. It contains anorthite and hornblende, but no mica. Indeed, it may be called a kind of syenite.

3. Newry granite. There are in this vicinity two kinds of granite. Taking a line nearly N.S. through Newry from Goragh Wood through Wellington Inn on the south to Jonesborough, soda granite is found to the north of Newry, and potash granite to the south.

I may add that, with reference to the age of these rocks, the reviewer of Ansted's "Elementary Geology" ("Natural History Review," 1857, p. 26) classifies the Irish granites as follows:—

1. Granite of Leinster, post-Silurian, but ante-Carboniferous.
2. Granite of Down, post-Carboniferous.
3. Granite of Donegal, Carboniferous.

He also adds that the Cornish granite is also carboniferous.

The advance of foreign Geology continues progressive, although I am not aware of any new fields having been lately opened. The survey of India is going on satisfactorily, and, in unison with the railway system, will do much to develop the immense natural resources of that rich country. In Australia, also, much additional information is gradually obtained. It may be said that the gold mines have acted in the most powerful manner to stimulate the scientific tastes of our antipodean countrymen. From the Cape, also, we are continually receiving interesting details of the extensive chalk formation which runs through the district of Port Natal. The beautiful and accurate Geological Map of Europe, just published by Sir Roderick Murchison, is a great addition to the obligations which we are under to that indefatigable philosopher, and ought to be on the table of every student of Geology.

A remarkable paper has been read at the London Geological Society by Mr. Sharpe, on the last elevation of the Alps. He contends that there can be distinctly traced throughout the Alps three lines of erosion on the sides of the mountains, viz.:—

1. At from 9000 feet to 9300 feet above the sea.
2. At about 7500 feet above the sea.
3. At about 4800 feet above the sea.

From the uniformity of these lines, he concludes that the action must be due to the sea, and not to lakes.

In confirmation of these views, he examined the lines of watershed traceable in the excavation of the valleys. He finds them to range from 9000 feet (*mer de glace*) to from 2500 feet to 2600 feet above the level of the sea. There is also a great amount of *alluvium* formed in the Alpine valleys, and which has been excavated into terraces. These range at a considerably lower level, from about 3190 feet to 1000 feet above the sea.

The communications of Mr. Binney on the Permian Rocks of Scotland (to which formation he considers the red sandstones of the West of Scotland, with the exception of the Annandale beds, to belong); of Messrs. Plant and Brodie, on the Keuper Beds of Leicestershire and Warwickshire,—illustrate the connexion between the British and Continental formations. There has also been made an important discovery in Aberdeenshire of neocomian fossils. It appears that flint and greensand, containing greensand fossils, have been found in that county, and, what is still more remarkable, some of the fossils resemble more those of Scandinavia than of Great Britain. This points to a connexion between the northern cretaceous system and that of Scotland.

A further attempt at subdivision of the Oolite formation has been made by Dr. Wright, who contends, on very good grounds, that the lower oolite sands, which reach a considerable thickness in the south and midland districts of England, really belong to the upper lias. He comes to these conclusions chiefly on comparison of the fossils with those of Belgium, France, and Germany. Immediately above these sands there is a very remarkable bed, called the *Cephalopoda bed,* which has a considerable persistence through the district, and whose fossils have decidedly a liassic character.

With respect to Palæontology, I have already alluded to the most important discoveries of new fossils in the Cambrian strata of England and Ireland, by Messrs. Salter and Kinahan.

Professor Owen, in the twelfth volume of the "Proceedings of the London Geological Society," describes a skull of the musk ox, found in a gravel quarry near Maidenhead, and the original fossil is now preserved in the Museum of the College of Surgeons. It does not appear to differ very much from the living variety of the musk buffalo.

The same distinguished naturalist describes the *tibia* of a very remarkable gigantic bird, nearly the size of the ostrich, found in the lowest bed of the Paris *Calcaire grossier*, resembling the *Dinornis Cassuarinus* and other extinct birds in some respects, the gallinaceous birds in others—a new distinct genus. He gives it the name of *Gastornis Parisiensis.*

He also describes, in the same volume, a remarkable collection of mammalian remains, from the red clay of Suffolk, which he pronounces to be, for the most part, of Miocene date. Among these are extinct species of Rhinoceros, Tapir, Wild Boar, Horse, Mastodon, Decranoceros (an extinct deer), Felis, Canis, Bear, and several genera of Cetacea. However, the most interesting discovery to us is that of a bone of the left antler of a deer, resembling the *Megaceros Hibernicus.* This would give the animal an immense range, from the Miocene almost to our times. Professor Owen also mentions that this animal has been found in the Pleistocene brick-earth of Essex.

I cannot conclude without drawing your attention to a most valuable treatise by Mr. Dominick M'Causland, which has been published during the year, and is entitled "Sermons on Stones." I have perused it with great interest; and, although he does not profess to have made any discoveries of new facts, the views he adopts are original, and illustrated in a clear and eloquent style.

Starting from the proposition that—"Whatever has been written under the Divine inspiration cannot be inconsistent with anything created by the Divine Hand—God is truth, and His Word cannot be refuted by His works,"—the chief difficulty is the precise meaning of the word "Day."

PLATE V

Fig 1.

c

a

d

Fig 2.

a

b

Fig 3

Fig 4.

Fig 5.

Jan^y 1857.

Buckland and Chalmers have taken it in a natural sense, and have, therefore, contended that Moses' narrative was not an account of the events which occurred from the beginning of the Creation, but only of certain events which occupied the period of the six natural days that preceded the birth of Adam.

Mr. M'Causland explains it as a period of indefinite duration, in which sense it appears to be frequently used in the sacred volume.

He details accurately the different steps of the Creation (except that he could not be aware of the important recent discoveries in the Cambrian strata), and shows how everything came in its regular order until the creation of man. It is a most valuable addition to our works on Natural Theology; and I trust that so much progress has been made in our science, that neither the enemies of Revealed Religion, nor the almost equally dangerous advocates of untenable interpretations of the Bible, will be able to rest their arguments on the unsoundness or contradictions of geological theories.

WEDNESDAY EVENING, MARCH 11, 1857.

Dr. Croker in the Chair.

The Society met on the above evening, when the following gentlemen were elected members:—

1. Alexander Tate, Esq., C.E., Santry; 2. Geo. Phayre, Esq., C.E., Sandymount.

The reading of Mr. John Kelly's paper on the Subdivision of the Carboniferous Formation in Ireland was continued, and the discussion to which it gave rise was postponed until the meeting in the month of April.

The Rev. Professor Haughton also communicated the following—

NOTES TO ACCOMPANY FIGURES OF SOME DISTORTED FOSSILS FROM THE CLEAVED ROCKS OF THE SOUTH OF IRELAND.

In a short paper published by me in the "Philosophical Magazine" for December, 1856, on Slaty Cleavage and Distortion of Fossils, I have established the following laws from measurements made on fossils distorted by cleavage:—

1st Law.—*If the trace or intersection of the plane of cleavage and plane of bedding be drawn, the greatest distortion or elongation of the fossils lying in the plane of bedding is parallel to this intersection.* (Page 410.)

2nd Law.—*The distortion of fossils produced by cleavage, estimated in a given direction, such as parallel to the intersection of the planes of cleavage and bedding, varies with the angle between these planes, being greatest when the angle is greatest, and least when the angle is least.* (Page 411.)

3rd Law.—*The compression in a cleaved rock is greatest in a direction perpendicular to the planes of cleavage.*

As many persons, not familiar with the appearance of fossils distorted by cleavage, have felt some difficulty in following the argument of that paper, I have thought it desirable to give to this Society a few illustrations of the distorted fossils of the south of Ireland.

I should first premise that in the two plates containing the figures of the fossils the horizontal line is supposed to be the intersection of the planes of cleavage and bedding, and the vertical line is the dip of the bedding in most instances, and never deviates far from that line.

What I call the *Distortion* of a fossil is the quantity—

$$\rho = \frac{m}{n} \times \frac{N}{M}. \tag{1}$$

In this expression the fraction $m : n$ represents the ratio of the horizontal and vertical measurements of the figures as actually observed in their distorted condition; and the fraction $M : N$ represents the ratio of the same lines when the fossil is in its natural or undisturbed form.

In Plate VI. the Figures 1, 1A, 1B, 1C, represent fossils distorted by cleavage.

Fig. 1 is *Orthis crenistria* from the Carboniferous Slate of Ardoginna, Co. Waterford, with its hinge-line perpendicular to the intersection of cleavage and bedding.

Fig. 1A represents the same fossil from the Carboniferous Slate of Carrigaline, Co. Cork, with its hinge-line drawn out in the line of intersection of cleavage and bedding.

Fig. 1B is a fossil from the same locality as the last, viz., Carrigaline; but so changed by cleavage, both in and perpendicular to the plane of bedding, as to be hardly recognisable. I name it, with considerable hesitation, *Productus caperatus*.

3

4

3A

4A

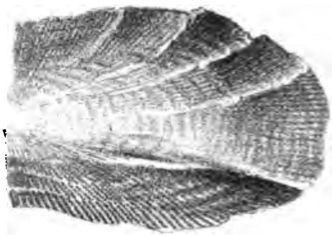
3 B

4B

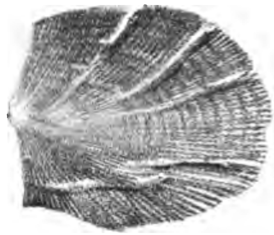
3C

4C

1



2

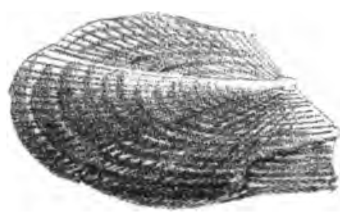


1 A

2 A

1 B

2 B



1 C

2 C

Forster & Co. Dublin

Fig. 1c is a beautiful specimen of *Euomphalus pentangulatus*, distorted by cleavage, from Little Island, Co. Cork, where these distorted fossils occur in great abundance in limestone, and have been frequently, from their form, described as Ellipsolithes, and considered as quite distinct from Euomphalus.

In the Figs. 2, 2A, 2B, 2C, the artist has reduced the distortion in the proportion of 5 : 4. In Plate VII., Figs. 3, 3A, 3B, 3C, the distortion is reduced in the proportion of 5 : 3; and it is evident to geologists acquainted with these fossils that this reduction of their distortion has nearly restored them to their natural shape. In Figs. 4, 4A, 4B, 4C, the reduction of the distortion is continued in the proportion of 5 : 2; and it is very instructive to observe that it has now become a distortion in the perpendicular direction, causing Figs. 1 and 1A to change characters in becoming 4 and 4A.

It is to be remembered that such specimens as 4, 4A, 4C, could not occur in practice, with the intersection of the planes of cleavage and bedding in the horizontal line. In fact, in the Figs. 1 and 2, the line of intersection of planes of cleavage and bedding is horizontal; in Fig. 3 there is either no cleavage, or its plane coincides, or nearly coincides, with that of bedding; and in Fig. 4 the line of intersection of planes of cleavage and bedding must have become at right angles to its former position, and be supposed vertical.

Since publishing the paper alluded to above, I have read with care the various papers published on the subject of cleavage by Mr. Sorby, and feel most happy to bear my testimony to their great value. His methods of research are quite different from my own; and I am glad to learn that the few results I have obtained independently, from the consideration of the distortion of fossils, confirm several of his results, which were obtained principally from microscopic examinations of cleaved rocks. One of the most interesting of our agreements relates to the great amount of compression occasionally occurring in cleaved rocks, which I have shown to amount to 10 and 11 degrees of relative compression at Tintagel and Garth—an amount of relative compression consistent with Mr. Sorby's observations, who has commonly observed 6 degrees of compression in well-cleaved rocks. There are several points of difference between my results and those of both Mr. Sharpe and Mr. Sorby, which will, no doubt, be cleared up by further research. The chief discrepancy between us is the following:—Both Mr. Sorby and Mr. Sharpe have observed an elongation in the line of dip (of cleavage?); an appearance which I have not found in any case, except that of South Petherwin, where it exists, but to a very small extent, and can only be discovered by calculation, as it is not sufficiently decided to be very sensible by direct observations.

ON THE SUBDIVISION OF THE CARBONIFEROUS FORMATION OF IRELAND.

BY JOHN KELLY, ESQ.

In the present paper I mean to treat of the several subdivisions of the Carboniferous formation in Ireland. While my chief object is to draw attention to one or two of those subdivisions, especially the supposed calp of Dr. Griffith, and in this case having, according to my views, to deal with an imaginary band of rock, I must be more particular than if I had a real tangible subject, which, in one part of the country, could be compared with other parts of the system. I mean to show that everywhere in Ireland this rock is mentioned as existing, it is a group of another part of the formation that is mistaken, and introduced into that place.

Before I proceed further, I will here observe, that it is not without some reluctance I stand up in this place in opposition to the views of Dr. Griffith—a gentleman with whom, I may say, I spent my whole life, and with whom I gained my own geological experience. He would be one of the first himself to join in correcting an error, if he were convinced of that error. From the great desire there appears to exist among geologists of eminence, within the last dozen years, to have the honour of founding new systems, and the confusion and drawback to the progress of the science consequent upon it, I believe there is no really good, unexceptionable system of the classification of rocks yet arrived at in Geology. It is a new science with us all; and many of its facts are capable of two or more interpretations. One man may account for a fact differently from another; and it is from conclusions drawn from the experience and views of different persons, in several countries, that we may expect to arrive at a satisfactory settlement of opinions on the subject. My convictions happen to be different from those of Dr. Griffith on the subject of his calp; and, however unwilling I may be to differ from him, it appears to me to be the duty of every member of this Society, when he examines a district, to give to the Society the result of his own experience, no matter with whom he may differ or agree.

This calp is a new subject in Geology. It was not known in any other part of Europe, until it got "a local habitation and a name" from Dr. Griffith in Ireland. Yet, it has not been questioned by any geologist, but accepted at his word, apparently because he was the most eminent teacher of the science in the country, at a time when it was in its infancy. The opinion regarding it was formed almost in the first days of geological knowledge, about the years 1810 to 1813, and before organic remains had been applied to the identification of strata, and, therefore, cannot be supposed to be above suspicion. It appears to me to be a very important subject, as it involves the great question—whether above 1700 square miles of country, coloured on the Geological Map as calp, be not the rocks of the Coal formation, as I believe them to be, and may not have, in some places, a sufficient accumulation of the strata to contain coal? At all events, inquiry regarding it will be useful to the science we have joined together to cultivate, either in getting altered what may be erroneous, or in establishing the views already entertained.

Mr. Kirwan, a man of some repute in science in Dublin about the year 1800, was the first who gave any account of a black argillaceous limetone, got at Donnybrook, Rathgar, and other places in the vicinity of Dublin, to which he gave the name of Calp. His, however, was a mineralogical notice, and bore no reference to any geological group.

Dr. Griffith adopted the name, and gave the rock an important position in Geology, by making it a subdivision of the Carboniferous formation. He divided the mountain limestone into three parts—the lower limestone, the calp, and the upper limestone. The localities where these subdivisions occur are shown on the several successive issues of his Geological Map, and its position in the Carboniferous formation may be seen in the explanatory section at the bottom of the Map.

In the Report of the Railway Commissioners for Ireland, 1838, there are several Appendices. The first of these is an "Outline of the Geology of Ireland," written by Dr. Griffith, who was one of the Commissioners. In this document we have his matured views of the calp described; but, as it is not in the hands of many, and may not ever be reprinted, I shall make a few quotations, to show on what data those views are founded. As I shall have occasion to reply to some of the paragraphs of the "Outline" which I will quote, I think it well to number the extracts as I proceed, for sake of reference. At page 8, and a few of the succeeding pages of this Outline, is given his subdivision of the Carboniferous formation, in substance as follows:—

1. "OF THE SECONDARY ROCKS.—We next proceed to the consideration of the great interior valley, which is entirely composed of secondary rocks, consisting of the Old Red Sandstone, Carboniferous Limestone, and Coal, and its accompanying strata."

2. "As far as our present knowledge extends, the following, in an ascending series, appears to be the order of succession of the different groups or assemblages of rocks belonging to each period of deposition:—

"I. Yellow sandstone, limestone, and shale.

"II. Lower limestone.

"III. Impure argillaceous limestone, called calp, black shale, and sandstone.

"IV. Upper limestone."

3. "LOWER LIMESTONE.—This division forms by much the most extensive portion of the series in Ireland. In the northern counties of Fermanagh, Cavan, Leitrim, and Roscommon, it is in part covered by the upper division of the series, but in the midland and southern counties, with the exception of the calp valley of the counties of Dublin, Meath, and Westmeath, it forms the surface rock throughout the greater portion of the limestone country."

4. "CALP, or black shale series.—The name 'calp' was given by Mr. Kirwan to the black argillaceous limestone of the neighbourhood of Dublin, which alternates with black shale, and contains flattened spheroids of pyritous clay ironstone. In some districts the lower beds of this series consist of alternations of sandstone, shale, and limestone, more or less pure; in others, the sandstone is wanting, but the upper beds in all consist of thin, alternating beds of impure limestone and shale. In some localities the lower beds, in addition to the sandstone and shale, contain indications of carbonaceous matter; and impure beds of coal, varying in thickness from half an inch to two inches, have been observed: which circumstance, as in the case of the yellow sandstone, has led to so many fruitless trials for coal."

5. Page 10.—"The thickness of the calp series, where fully developed, is very considerable. On the north-west coast of the county of

Leitrim it exceeds 1700 feet; though in the county of Cavan, between Belturbet and Ballyconnell, it is not more than 400 feet."

6. Page 11.—"This division is much more fully developed in the northern districts of the Carboniferous Limestone than in the midland or southern; and it was solely from the clear exhibition of their strata, as seen in the precipitous cliffs of the remarkable Carboniferous mountain district of the counties of Sligo, Fermanagh, Cavan, Leitrim, and Roscommon, that the subdivision of the series has been attempted."

7. Page 11.—"The calp and shale division is, perhaps, best developed on the west coast of the counties of Leitrim and Sligo, between Ballyshannon and Benbulben. In this line of section, the strata dip to the southward at an angle of from 2° to 5° from the horizon. The lower limestone of Ballyshannon is succeeded by beds of black shale, containing balls of clay ironstone interstratified with impure argillaceous limestone. These beds continue as far as the parallel of Bundoran, where they are succeeded by a series of alternations of gray, and occasionally reddish-gray sandstone and black shale, with argillaceous limestone. Some of the sandstone beds contain casts of Calamites enveloped in coaly matter; and some thin but irregular beds of coal have been observed, though none worth working have been discovered; and from the nature of the country it is improbable that any such do exist. These beds are succeeded by alternations of black shale, with impure argillaceous limestone or calp, which form the precipitous cliffs of Dartry mountain facing the west, and which near the summit are capped by the upper or splintery limestone."

8. Again, at page 10.—"Excepting in the northern counties, where the succession of the limestone series is fully and clearly developed, it is almost impossible to determine with any precision on the point where the lower limestone may be said to terminate, and the calp or the upper limestone to commence. In many localities of the midland and southern counties, the black shale or calp series is altogether wanting, or it occurs so sparingly that without a laborious and minute examination it will not be detected."

9. Page 11.—"It would be tedious, and almost endless, to enter into a particular description of the numerous localities in which the calp series occurs in the north of Ireland: at present we need only observe, that the shale district, extending from Emyvale in the county of

Monaghan, to Brookborough in the county of Fermanagh, known by the name of the Slieve-Beagh Mountains, has long been considered to be the true Coal formation, and sanguine expectations have been entertained of the discovery of workable beds of coal; but having ascertained that in the order of succession it forms a portion of the calp series, it appears very improbable that these expectations will be realized."

10. Page 11.—"UPPER OR SPLINTERY LIMESTONE. This rock is of comparatively rare occurrence in Ireland, and its superficial extent is insignificant. Owing to its containing the greater number of the fossil organic remains which occur in the lower limestone, it is difficult in some localities to distinguish between them, particularly where the calp series is wanting, which frequently happens."

11. Page 12.—"In the valley of the Barrow at Carlow, where the whole Carboniferous Limestone series of the south is clearly developed, it would appear that the calp or black shale division is wanting; and that the upper limestone rests directly on the black marble beds of the lower."

12. Page 12.—"In Belmore mountain, the thickness of the upper limestone amounts to 650 feet. In Benbulben, it is 500 feet; and at the eastern base of Culkagh mountain, in the county of Cavan, it is 600 feet."

13. Page 13.—"MILLSTONE GRIT. Rocks decidedly belonging to this series are only to be met with in the mountain district surrounding Lough Allen, in the counties of Roscommon, Leitrim, Cavan, and Fermanagh, hitherto known by the name of the Connaught coal district; and in the shale district extending from Drumquin, in the county of Tyrone, to the neighbourhood of Pettigo, in the county of Fermanagh."

I have now come to an end of those paragraphs of the "Outline" to which I mean to have reference; they are thirteen in number.

As the subdivision of the Carboniferous formation stands arranged in this "Outline of the Geology of Ireland," I object to it, and am prepared to maintain that a great part of it is visionary. The subdivision of the limestone, as given at the quotation No. 2, and the descriptions which explain and accompany it are not borne out by the facts, as I shall endeavour to show. The geological phenomena which are visible in the counties of Cavan, Fermanagh, Leitrim, and Sligo, may be interpreted, without any difficulty, by means of the three members of the Carboniferous formation set forth in No. 1, the Old Red Sandstone, Mountain Limestone, and Coal Rocks; and these afford a reference for every rock in the localities, described in the most simple manner.

In proceeding to show my reasons for the statements I have made, and my views on the subject generally, I shall notice the quotations from the "Outline" as nearly in consecutive order as I can.

In quotation No. 1, the author says:—"The secondary rocks are divided into Old Red Sandstone, Carboniferous Limestone, and Coal, and its accompanying strata."

It is remarkable that the Carboniferous Slate, that is, a slaty band which lies between the Old Red Sandstone and the Limestone, has not been noticed at all in this "Outline." Mr. Griffith subsequently introduced this member into his classification, as shown upon his recent Maps, and it is a good and true member. It is well developed on the shore at Poulscadden, near Howth; also on the shore near the Martello Tower at Portmarnock, in the county of Dublin; and many other parts of Ireland. With this subdivision, the natural succession in the Carboniferous formation is—

1. Old Red Sandstone.
2. Carboniferous slate.
3. Limestone.
4. The Coal series.

Each of those subdivisions is composed of a different mineral substance from the others. The bulk of the Old Red Sandstone is composed of red sand; the Limestone of lime; and the Coal shales of argillaceous or clayey matter. There are, however, modifications in the subdivisions which require some explanation, into which I shall enter in detail as I proceed.

Athough those subdivisions differ so widely from each other in mineral character, yet, as a whole, the system exhibits the remarkable circumstances:—1. That the beds of which it is composed are parallel to one another. 2. That they rest unconformably on the inferior or underlying rock. 3. That they are covered unconformably by the superior or overlying rock. 4. That this parallelism of the strata clearly points to one great geological epoch, in which the whole suite, from beginning to end, was deposited, without any great catastrophe in the succession.

The Old Red Sandstone is the lowest of those subdivisions. It may itself be divided into three parts:—First, or bottom layer. Red conglomerate, composed of rounded pebbles of white quartz, brown quartz, jasper, and fragments of other rocks, united by a mineral paste. In some localities the conglomerate is composed of flattish, rounded stones of mica slate, as at Cushendall, in Antrim; sometimes of green chloritic slate, or green grit, as at Lane, and at Shenick Island, near Skerries, in Dublin. Its thickness varies from 20 to 60 or 80 feet in different places. 2. Next is a series of beds of red sandstones and red shales, from 200 to 600 feet thick. 3. The upper part exhibits thick beds of sandstone, of a whitish or yellowish colour. This upper part is the yellow sandstone, which sometimes contains a band or two near the top of black shale, interstratified with thin beds of limestone, full of the fossils of the limestone. This yellow part of the Old Red varies from 50 to 200 feet in thickness. The whole thickness of the Old Red Sandstone in Ireland averages about 1000 feet.

I am aware that this subdivision, which, in former times, was included in the Carboniferous formation, has been recently cut away from it, and joined with another rock, which lies below it, sometimes directly in contact with it, and both together now called Old Red Sandstone. I could wish this separation had never been made, for it blots out a great line of demarcation which nature has made, and which ought not to have been blotted out. Botanists and zoologists, in devising their subdivisions, seek for the strongest lines of demarcation between the groups of their several orders and classes. This golden rule seems to have been totally overlooked in our science. The strongest and most prominent boundary line made by nature in Geology is a sedimentary unconformability. It is the chasm between two formations. It marks the time of a change, sometimes of a great catastrophe, which occurred at the end of one formation, and before the commencement of depositing materials for another. At the end of the Silurian period, and immediately before the Carboniferous formation, there appears to have been a time of unusual convulsive movement in the system of rocks which had then been formed. By this movement the beds were made into great folds, the tops of those folds often broken and carried away, leaving those beds turned up on their edges. This period of time coincides with one of the chasms I have been describing, in which no rock appears to have been deposited.

The conglomerate of the Old Red Sandstone, which forms the base of the Carboniferous system, was the first or lowest deposit laid down on the older beds after the period of disturbance just described. It is spread out, in all places I know, upon the upturned edges of the supporting rocks, in beds varying but little from the horizontal—thus forming the foundation of a new system. Those supporting rocks are different in different places: sometimes mica slate, more generally clay slate, or gray grit, sometimes brownstone, sometimes quartz rock, or porphyry, or greenstone, or granite. I look upon this conglomerate as a most important index in geology. Besides being the beginning of a new system of rocks, it is the boundary between two distinct periods of organic life; the fossils below it differ in genera and species from those above, and, besides this, there is a well-marked difference in the lithological character of the rocks also, the lower and older being much harder and more quartzose; the upper, softer.

The fossil evidence, so far as it goes, supports this view, and forms a link to tie this Old Red Sandstone inseparably into the Carboniferous formation. Near Cookstown, in Tyrone, there are beds of Red Sandstone near the base of this group, and beds of red limestone, both of which contain fossils common in the mountain limestone. There is now in the Museum of Irish Industry, at Stephen's-green, Dublin, collected by Colonel Portlock, from the river at Kildress, from Red Sandstone in the very lower beds of this group—

Productus fimbriatus,	Spirifer lævicosta,
,, semireticulatus,	Retzia ferita,
,, Martini,	Rhynconella ventilabrum,
Leptæna crenistria,	Cnathopsis fungites,
,, Sharpei,	

—nine species; all common in the limestone.

In beds of red limestone, at Castle Espie, in the county of Down, which occur in the lowest beds of the Old Red Sandstone, there are—

Actinoceras giganteum,	Orthis cylindrica,

and some species of Rhynconellidæ, common in the mountain limestone.

Professor Haughton, of Trinity College, has in his Museum the following fossils, got in whitish-brown *sandstone*, near the top of the Old Red, at Porter's Gate, Hook Point, Wexford—

Productus caperatus.	Leptæna crenistria.
,, setosus.	Lithodomus dactyloides.
,, concinnus.	Sanguinolites sulcatus.

These are all common in the mountain limestone and in the Carboniferous Slate.

Besides the foregoing, which are in pure sandstone rock, there are others got in shale and limestone beds, which are interstratified with the yellow part of the sandstone near the top, and in this shale are found fifty or sixty species of the common fossils of the Carboniferous Limestone at Porter's Gate, near Hook Point, and in many other places.

I look upon those fossils got in the Old Red Sandstone—some of them in the bottom beds of it at Kildress and at Castle Espie, some in the middle at Kildress also, and some in the upper part at Hook Point, in Wexford—as a link made by Nature to tie this Old Red Sandstone group up into the Carboniferous formation; and this fossil evidence, together with the physical considerations before mentioned, to be conclusive as to the propriety of leaving the Old Red Sandstone according to the arrangement in which it stood twenty years ago; and, further, I consider the modern mutilation of cutting away this Old Red Sandstone with its conglomerate base, parallel beds, and fossils, from the Carboniferous formation, into which it is tied by nature, as I have described, and joining it to a rock which belongs to an older epoch in the Earth's history, and calling the two distinct things by one name, as has been recently done, as a most injurious infringement on proper classification, and calculated to retard the progress of the science.

The Carboniferous system has thus suffered by recent changes. The Old Red Sandstone of former days, as just stated, has been cut away from its lower part, and a slice of the New Red Sandstone stuck upon it above. In this change two of the greatest chasms, the most striking boundaries that Nature made between her groups are totally disregarded, that is, the sedimentary unconformability at the bottom of the Old Red conglomerate, and the sedimentary unconformability at the top of the Coal-measures. The old natural Carboniferous system is broken up, and now forms parts of two new unnatural systems. Any of the three new lines made by this change, as boundaries of formations, does not agree with the boundaries made by nature. They are all artificial. Other sciences are improving every day. Geology appears to be retrograding. It is to be hoped still that the Carboniferous system will be restored to what it was before the recent alterations, and that it will recover this fit of illness, brought upon it by too much attention from over-zealous doctors.

I have before alluded to the desire that exists among geologists of eminence to have the honour of founding new systems. The Devonian system, and the Old Red Sandstone (in Herefordshire, in England), are two of those; the Calp, and the Yellow Sandstone (in Ireland), two others; and those new systems, or subdivisions, are some of the results of the recent alterations.

Of the Devonian system I expressed my views in a paper read in this Society last year. I endeavoured on that occasion to show that there is no Devonian system in Ireland—no intermediate group between the Carboniferous and Silurian systems. Every rock and band of rock about the position where that system might be expected falls easily into either the Carboniferous system above, including, of course, its Old Red Sandstone, or the Silurian below.

I find that my views, derived wholly from Irish data, agree with those of Professor Sedgwick, himself one of the authors of the Devonian System, and above whom no one stands higher in this science. He says, in the Introduction to the "British Paleozoic Fossils," p. 23, in speaking of the Devonian:—"In Devon and Cornwall the above series has no base; and we are without any evidence as to the beds which are below the lowest Devonian group." He is right. It is no doubt the same in England and Ireland. Here we have it not at all; it is a thing of the imagination; there it is a baseless fabric. It is to be regretted that so much pains were expended by two of the most able of British geologists on a country penetrated with granite protrusions, and broken up by the faults and dislocations consequent on them. Had half the pains been bestowed on a good paleozoic country, such as Ireland, every fragment of the earth's crust in Devon and Cornwall could afterwards, by combining lithological character and fossils, be put into its proper place without confusion or difficulty.

The Old Red Sandstone of Herefordshire, though not in Ireland, is too closely allied to my subject to be passed over unnoticed. It is a matter on which I have often thought; but, for want of opportunity of such examinations as would be satisfactory to myself, I can only speak with diffidence. It appears to me that the chief part of the Old Red Sandstone of Herefordshire, described in "Siluria," p. 242, as 8000 or 10,000 feet thick, is a Silurian rock, and the equivalent of the brown rocks between Trillick and Pomeroy, in Tyrone, and the lower rocks about Dingle, in Kerry. In both places in Ireland the underlying fossiliferous Silurian rocks are conformable with the brown grits, which I have in another place called brownstone. So they are in Brecknock and Herefordshire, on the line from Llandeilo by Kingston to Aymestry. In physical characters, too, they agree. For a few days last autumn I examined the country between Abergavenny and Brecon, in Wales, and along the road for several miles south of the latter place I saw those brown, gray, and green grits and slates, and the best eye could not distinguish them from the Dingle grits or slates in grain or colour.

But it is stated that there is a regular passage from the Old Red Sandstone of Herefordshire downwards into the Silurian, and upwards into the Carboniferous system of South Wales. We have the passage downwards from our brownstone into the Silurian fossiliferous bands; but we have no such passage as that described upwards in either the Dingle or the Tyrone district, and it appears to me very doubtful that such a passage exists even about the Vans of Brecon: for it must be there, if anywhere.

Sir Henry de la Beche seems to have recognised an unconformability in this district; for, in the "Memoir of the Geological Survey of Great Britain," vol. i., p. 59, he says:—"On the north of the great coal-fields of South Wales and its supporting limestone the upper part of the Old Red Sandstone forms a range of lofty land, of which the Vans of Brecon attain the highest elevation (2682 feet). From the small angle of the dip the continuation of the beds forming the summits of the Vans is only a few feet beneath the Carboniferous Limestone, near Merthyr Tydvil." Again, at p. 60, he says:—"Proceeding towards Carmarthen, not only do we appear to find a mingling of sand more, at the same geological time, westward than eastward, but also an *overlap of the higher arenaceous and conglomerate series upon the lower and marly ac-*

cumulations of the Old Red Sandstone; the Carboniferous Limestone and Coal-measures over the Silurian rocks."

What is this overlap of the higher arenaceous and conglomerate series, and the rest, over the Silurian rocks? It appears to me to be this:—That the conglomerate of the Vans of Brecon, or its equivalent, lies unconformably on the Silurian rocks near Llandeilo, and, of course, also on the Old Red Sandstone of Brecknock and Herefordshire; for, be it remembered, that the two are conformable.

This leads to the conclusion that this Old Red Sandstone is divisible into two parts, the conglomerate and sandstone of the upper part at the Vans of Brecon being the base of the Carboniferous system, and there lying unconformably on the lower or supporting Old Red Sandstone, as it does at Dingle in Kerry, and at Clogher in Tyrone.

As well as Sir Henry de la Beche, already quoted, Professor Sedgwick appears to entertain the same views that I do—mine taken, as before, from Irish data. He says, in the work already quoted, Introduction, p. 28:—"Though the Devonian series of the Herefordshire type seems to pass downwards into the upper Silurian groups, it does not appear to pass upwards into the Carboniferous. There is generally a palæontological and physical gap between them, which is in many places obscurely indicated by the upper conglomerates of the Old Red Sandstone."

His upper conglomerates of the Old Red Sandstone of Herefordshire appear to me to be the same as my lower conglomerates of the Carboniferous. His physical and palæontological gap I take to be the unconformability at this point, and the difference of fossil genera and species above and below, of which I have already spoken. Two coincidences of opinion more close than these could scarcely be met with on a subject of this kind.

I have been told that cases occur on the north border of the coal-field of South Wales where the coal rocks, limestone, conglomerate, and all, could be shown lying conformably on the Old Red Sandstone of Brecknock and Monmouth. This, in a few local cases, I can easily believe; for, in the rolls that occur in the older strata in so large an extent, it is very probable that the base of the Carboniferous formation, which has a remarkable persistence here on the great scale, may coincide now and then with the underlying undulations at an anticlinal or synclinal point, though three-fourths of the observed cases along the junction be positively unconformable.

Indeed, the general unconformability of those two may be inferred from a mere inspection of the Map of Siluria itself, with the dips marked on it from the new one-inch Map of England. In Herefordshire and in Brecknock the general strike of the so-called Old Red Sandstone is S.W., and the dip S.E. The strike of the Carboniferous rocks of South Wales may be taken in a general way, in the vicinity of the Vans of Brecon, by the outcrop of the limestone along its northern escarpment between Abergavenny and Llandeilo, and this is east and west. Here the two strikes clash; they do not coincide, but make an angle with one another of about forty or fifty degrees. This shows that the upper or Carboniferous beds must lie unconformably on the lower brown beds, otherwise the strikes of the two groups should be parallel.

The Old Red Sandstone of Scotland, being a part of the subject, calls for an observation. I cannot speak of this except from analogy. It is said to be nearly 2000 feet thick in three mountains in Rosshire—Coulmore, Coulbeg, and Suilvein; and it is reported to be several thousand feet in thickness in Caithness and other places, and to consist of both red and gray grits. So far it resembles the Tyrone brownstone, and the lower rocks of the Dingle district also, which are of Silurian age.

In 1855 I saw a little of the Old Red Sandstone on the north side of the valley of the Forth and Clyde, in Scotland. I believe the conglomerate at Callander to be the base of the Old Red of the Carboniferous formation, and the equivalent of that rock in Ireland.

From what I have just stated, it will be understood that there is a strong conviction on my mind that the Old Red Sandstone of modern times, as I said before, consists of two parts: the upper, which is clearly tied into and inseparable from the Carboniferous system; and the lower, which is as clearly associated with the Silurian; and as Nature separated them by one of her greatest chasms, so they ought to be separated by man. The name should undoubtedly be retained for one of them; but whether should it be the upper or the lower? My views lead me to prefer keeping the name to the upper, and I shall state why.

In the early days of Geology the division above alluded to was not recognised in England, and the two were packed together where they happened to be in contact, and said to be 10,000 feet thick. Indeed, this may be said to be the case up to the present time. The carboniferous part, however, is far more general in the British Islands than the brownstone, which was included with it in certain districts by mistake or oversight, for want of being recognised. So far, then, as precedence goes, I should say the upper or the base of the Carboniferous should retain the name, and let the Silurian, or lower part, be provided with a new name. I have called it brownstone, to distinguish it from the upper band of rock, but I shall be happy to adopt a better name with the majority of geologists, when it may be found. I do, however, think it highly objectionable to call the two upper and lower Old Red Sandstone, as I have lately heard them called, because the upper is the base of the Carboniferous formation; it lies, as before stated, indiscriminately upon mica slate, clay slate, gray or green grit, primary limestone, quartz rock, porphyry, greenstone or granite, in all which cases, though there is an upper, there is no lower sandstone in contact to keep it company as a counterpart. The Cambrian rocks have been made upper and lower, but they are one great group divided. It is so also in the Silurian. There are upper and lower oolite, and lias, and chalk, and tertiary, but they are always parts of the same group. To make these two sandstones upper and lower, where the lower is absent in nine cases out of ten, and when it is always a rock of another geological epoch, does not appear to me to be either an eligible association or nomenclature.

About Dingle and other parts of the south of Ireland the green, gray, and brown grits, and similarly coloured slates, are so intimately associated by interstratification with each other in thick and thin bands and beds, as to form one inseparable group. The rocks about Brecon in Wales are exactly similar. It therefore appears that the old name graywacke would not be still unsuitable for this group. It would have the merit of keeping out novelty, and abiding by the first name given to those rocks—a thing much to be desired in Geology as well as in Palæontology.

Regarding the arrangements made in pars. 1 and 4, the Old Red Sandstone is in its proper place. The Yellow Sandstone is a part of the same, that ought not to be made a separate subdivision. The Lower Limestone is the lower part of the Limestone. The Calp, I believe, is a pure fiction. The author himself, at the quotations No. 8, 10, and 11, admits it does not exist in the south of Ireland. I expect to be able to show that it is not in the middle or the north. The Upper Limestone is the upper part of the Limestone, the whole of it being one mass, and undivided, with only trifling exceptions, which I shall particularize; and the millstone grit is the base of the Coal-rocks.

It is remarkable that the Carboniferous Slate, that is, a slaty band, which lies between the Old Red Sandstone and the Limestone, has not been noticed at all in this "Outline." Dr. Griffith subsequently introduced this member into his classification, as shown upon his recent Map, and it is a good and true member. It is well developed on the shore at Poulscadden, near Howth, about Portmarnock Martello Tower, and thence to Malahide in the county of Dublin, and a hundred other places.

At par. No. 2 the Carboniferous Limestone has been divided into four parts:—

1. Yellow Sandstone, which is stated, at page 9 of the "Outline," to be 600 to 1000 feet in thickness.

2. Lower Limestone; thickness not given.

3. Calp, alternating with black shale and sandstone, which is stated, at par. 5, to be, at Bundoran, 1700 feet in thickness.

4. Upper Limestone, which at par. 9 is given as 500 to 650 feet thick.

Besides the Yellow Sandstone, which may be the subject of a future paper in this Society, there are three other divisions made of the limestone in this passage of the "Outline," of which the middle one is the Calp, which is further described at par. 7.

There are four large calp districts in Ireland, shown on the latest issue of Mr. Griffith's "Geological Map."

1. The Bundoran district, which occupies parts of the counties of Fermanagh, Leitrim, and Sligo. It extends from Lough Erne to Bundoran, and thence along the sea-shore to Grange in Sligo. This district occupies about seventy-five square miles.

2. The Slievebeagh district, which lies between Lough Neagh and Lough Erne, extending from Dungannon to Brookborough, thirty miles, and about eight miles wide, or 240 square miles.

3. The Dublin district, which occupies a great part of the counties of Dublin, Meath, and Westmeath, comprising more than 1000 square miles.

4. The Galway district, which lies chiefly between Banagher and Athenry, above 450 square miles.

I shall make observations on each of those districts, beginning with that of Bundoran.

Bundoran is situated on the south coast of Donegal Bay, about three miles to the west of Ballyshannon. It will be seen by a glance at the "Geological Map of Ireland," that, a few miles inland from the northern shore of Donegal Bay, there is a broad, well-developed band of Old Red Sandstone, extending from Dunkineely to Lough Esk, crosses the Londonderry road three miles east of the town of Donegal, and continues for three miles south of it, where it ends abruptly, apparently cut off by a fault. Three miles farther on, and a mile east of the village of Laghy, it appears again, and in a narrow band proceeds to a mile south of the parallel of Ballintra, where it disappears; and from this to Ballyshannon, five or six miles, the mica slate and limestone are in contact, without the usual intervening Old Red, which is not at the surface at Ballyshannon, nor round thence by Lough Erne to near Pettigo. At this place it again appears, and continues five miles farther north-east to Grouse Lodge. It is there well developed. From this place it curves to the north towards Killeter, and then eastward it extends, in a broad expanse, to Mountjoy Forest, north of Omagh.

I have been thus particular in describing the appearance and the absence of this band at intervals along the mica slate border, to show a reason for what I believe, but cannot see, and that is, that the disappearance of the Old Red at Ballyshannon does not arise from its being absent from its position under the Carboniferous Limestone along the shores of Donegal Bay, but from being buried in a fault along the junction of the mica slate and limestone. It is not going too far to assume that it underlies the whole of the Carboniferous Limestone round the bay.

At par. 7 it is stated that the Calp and Shale division is best developed on the west coast of the counties of Leitrim and Sligo; and more in detail Mr. Griffith describes a section from Ballyshannon to Benbulben. He says:—"In this line of section the strata dip to the southward, at an angle of 2° to 5° from the horizon. The lower limestone of Ballyshannon is succeeded by beds of black shale, containing balls of clay ironstone, interstratified with impure argillaceous limestone. These beds continue as far as the parallel of Bundoran, where they are succeeded by a series of alternations of gray, and occasionally reddish-gray, sandstone and black shale, with argillaceous limestone. These beds are succeeded by alternations of black shale with impure argillaceous limestone, or calp, which form the precipitous cliffs of Dartry mountain, facing the west, and which near the summit are capped by the upper or splintery limestone."

Putting this succession into something of a tabular form, it is—

1. Lower Limestone at Ballyshannon.
2. Black shale, with impure argillaceous limestone.
3. Gray and reddish-gray sandstone, with black shale.
4. Black shale and impure limestone.
5. Upper limestone.

I object to this arrangement and succession for many reasons, which I shall endeavour to explain.

1. I think the sandstone about Bundoran is the Old Red Sandstone, and not calp sandstone, or any other imaginary band of rock.

2. I think the description given of the shales in Bundoran Bay, at the quotation No. 7, is not correct, nor the succession stated in the same paragraph.

3. I think the great wedge-shaped mass of calp about Bundoran, partly described and partly inferred, is a fiction.

4. I think the appearance of Lower and Upper Limestone, described in quotation No. 2, attributable to a great fault that exists in the vicinity of Lough Erne and Bundoran, and not that there are two separate bands of limestone.

First. Immediately to the west of Bundoran, on the shore, there is a ravine, several yards long and a few feet wide, with perpendicular faces, worn out by the action of the tide. A man can go through this ravine at low water, and lay his hand, on the north side of it, on sandstone rock; and, on the same level, on the south side, he has the black shale and limestone of Bundoran Bay (see Plate VI., Fig. 1). The ravine appears to be on a perpendicular fault, in which the one rock is thrown up to the surface, or the other let down, so as to be brought into juxtaposition with each other.

There is another, a clear case of a similar fault on the north side of Ballyshannon Harbour, at Kildoney, between two groups of rock sandstone and limestone, the beds of both being nearly level, as at Bundoran. By this fault they are brought into juxtaposition with each other. There is no trace of superposition, but only simple contact. The whitish sandstone at Kildoney Point, and that at Bundoran, are both insulated; and this circumstance, with the faults, renders positive proof of sedimentary succession at the junction unattainable. Here, however, are two rocks of different kinds in contact: sandstone and limestone at Kildoney; sandstone and black shale at Bundoran; not one over the other, but one beside the other, separated by a vertical fault; clearly showing the one thrown up, or the other down from its original position (see Plate VI., Fig. 2). Under such circumstances, it is no great wonder that a mistake might be made by a hurried observer who travelled over the country from Ballyshannon to Bundoran, and that he adopted the geographical instead of the geological succession.

I believe similar cases to be numerous in the neighbourhood. The country about Ballyshannon, and the valley of Lough Erne, is beset with faults: some of them are of unusual magnitude, to one of which I shall allude presently.

I consider it more rational to suppose that those sandstones are the top of the Old Red, which we know exists a short way below, and which have been moved relatively upwards out of their original position by means of faults, than to imagine them, and call them calp sandstones, slipped down from a higher place, and resting in juxtaposition with the limestone at Kildoney, or the black shale at Bundoran; this calp sandstone being a rock which was not known in any part of the world before this idea was suggested to Mr. Griffith's mind.

As at Ballyshannon, so in other districts, rocks of different kinds are frequently brought together at the surface by means of faults. A good example of this kind occurs on the shore at Cultra, near Belfast, between high and low water-marks. At this place there are four or five whin-dykes, all cutting through strata which are nearly level, in a direction nearly at right angles to the line of shore (see Plate VI., Fig. 3). The little quay at Cultra is built on one of them. Each dyke is the boundary between two compartments of rock of different kinds: one of them is red sandstone; another is black shale, of the Coal series; a third, yellow magnesian limestone; a fourth, thin beds of red compact limestone, interstratified with red sandstone and red shale; a fifth, red sandstone again, and so on. Each compartment between the dykes is, say, a block of rock. Some of those have been pushed up, some let down, and, as the strata are nearly level, what was once one continued bed is now broken up, and in position on different levels between the dykes. The surface of the whole group was afterwards worn down to one general plane by denudation. In such a locality a man, stepping across one of the whin-dykes, may get on higher or lower strata by 20, 50, or 100 feet, at one side of the dyke than on the other.

2. My second objection to this classification is this—

The succession at Ballyshannon begins with the Lower Limestone, and is in ascending order, as described in quotation No. 7. This section I interpret in another way. Instead of an ascending succession, I take it to be that the case is reversed, and that, proceeding from Ballyshannon to Bundoran, the geologist, travelling over the strata westwards, is descending, instead of ascending, in the series. The black shales and interlaminated limestones, both in Abbey Bay, near Ballyshannon, and Bundoran Bay, contain a profusion of those fossils, both shells and corals, which abound in the Carboniferous Limestone; and the whole character of this band—limestones, shales, and fossils—accords with the Carboniferous Slate of other places, or that band which lies next below the Carboniferous Limestone almost everywhere in Ireland, and is especially similar in character to the Carboniferous Slate, where the succession admits of no doubt, about Bruckless and Dunkineely, north of Donegal Bay, and in three or four places on the coast of Sligo and Mayo, where Old Red Sandstone, Carboniferous Slate, and Limestone are all clearly visible in succession.

I shall more particularly point out a means of identifying this fossiliferous shale and limestone group when I come to discuss two black shale bands in the Dublin district, the upper one of which, called the Calp of Dublin, is almost destitute of fossils, and such as it does contain are peculiar to itself.

The description of the second member of this succession appears to me to be inaccurate, as if it had been copied from some wrong page of a note-book by mistake. Balls of clay-ironstone have been described in it. In searching for the fossils of the Carboniferous Limestone I examined carefully the cliffs and the northern shore of the river Erne, from Ballyshannon downwards towards the sea, at low water. I also examined in Bundoran Bay almost every bed of rock. The black shale, interstratified with impure argillaceous limestone, is there; but I saw neither beds nor balls of clay-ironstone. Beds and balls of clay-ironstone are usually met with in the coal-shales, and not elsewhere. They abound in the millstone grit district between Pettigo and Drumquin, and in all the coal-shales round Lough Allen; but they do not occur in any Carboniferous Slate that I know. This division is well developed on the sea-shore between Portmarnock and Malahide, in the county of Dublin, and the geologist may look in vain there, as well as in Abbey Bay or Bundoran Bay, for a bed or a ball of clay-ironstone.

The third member of the succession, the gray and reddish-gray sandstone at Bundoran (which to my eye seems yellow), is not Calp Sandstone, but Old Red Sandstone, which, according to the views I entertain, lies under the Carboniferous Limestone of Donegal Bay, and is thrown up here by a fault. From Bundoran it continues along the shore by Mullaghmore to the base of Benbulben, near Sligo, a limestone mountain with precipitous escarpments and level beds. The fossiliferous shale and limestone in Abbey Bay, close to Ballyshannon and Bundoran, is the Carboniferous Slate, and the limestone at Ballyshannon the ordinary Carboniferous Limestone, being on a low level here, as compared to what it stands in at Dartree and Benbulben mountains, the cause of which I shall presently explain.

Leaving Bundoran again, and travelling southward, there is no doubt at all of the succession. The Old Red Sandstone of that place is covered by Carboniferous Slate, having the same dip and strike. Some of this slate or shale is fine-grained, some coarse-grained, all fossiliferous and interstratified with beds of dark-coloured, impure limestone, which in this district increase in number and thickness in ascending, until they are covered by the gray limestone of Dartree mountain, which crowns the precipice, without any apparent interruption of the succession.

Third objection.—The sandstone at Mullaghmore, west of Bundoran, on the sea-shore, is 209 feet above low water, and dips and accumulates southward, till it forms a band four miles wide, and several hundred feet in thickness. The Calp, which is stated at quotation No. 5 to be 1700 feet thick at Bundoran, including these several hundred feet in thickness of sandstone, is at Drumahaire, twelve miles to the south, diminished, as may be seen on the Map, to a band of insignificant thickness, without any sandstone at all; thus forming a wedge-shaped mass twelve miles long, 1700 feet thick at the north end, and, say, thirty or twenty feet at the south. Can it be believed that such a wedge as this exists in the Carboniferous formation—one of the most remarkable for the persistence and parallel arrangement of its groups—One in which a bed of coal, or a bed of fireclay, two or three feet thick, has often been identified through a district for ten, twenty, or thirty miles?

Fourth objection.—Since the limestone at Ballyshannon, and the sandstone at Bundoran, may be matter of dispute, let us leave this debateable ground, and take the millstone grit. The base of this rock is as easily determined, and as certain as any boundary line between different rocks in geology. I may say it is particularly so in the west of Ireland, because the rocks are well exposed in precipices and high hills, and at this base form a junction of black shale and gray limestone—two rocks so entirely different in colour and mineral character as to be in no way likely to be mistaken for one another, or the line between them for any other line.

At par. 13 it is stated that "the shale district, extending from Drumquin, in the county of Tyrone, to the neighbourhood of Pettigo, in the county of Fermanagh, decidedly belongs to the millstone grit." This rock occurs also on the high mountain group south-west of Lough Erne, as shown on the "Geological Map." The base of this millstone grit, at Portinode, between Kesh and Pettigo, on the north shore of Lough Erne, stands at the level of the water, or about 150 feet above the sea. At Shean Hill, west of Churchhill, on the south side of the lough opposite, it stands at 1135 feet, that being the height of the trigonometrical point on the top of the hill, on limestone, near the base of the millstone grit. Here is a difference of 985 feet between two localities in the base of the same group, showing the base of the millstone grit to be lower on the north shore of Lough Erne than on the south by 985 feet, or, say, about 1000 feet; and the fact proves that a fault of great magnitude exists between them, as there is no curvature of the strata, and the rock in both places has a persistent dip southwards.

The seat of this fault, as I interpret it, lies on the northern boundary of a sandstone belt, seen on the "Map," which runs from the north-west corner of Lough Erne to Bundoran, where it enters the sea.

In estimating the amount of the fault, these 985 feet of horizontal difference would make half as much more, or about 1500 feet, if the dip at Portinode be persistent under the lough southwards as far as the fault, which is very probable, as the rocks visible in both places have the same low, general dip to the south, as just mentioned.

This fault I look upon to be the key to the geology of the district round it. By means of it, all the phenomena in its vicinity can be explained. With the millstone grit, of course, go up or down all the subdivisions of the Carboniferous formation, at one side or the other, of a fault which passes through them, and all the Carboniferous rocks north of the line of fault are, therefore, on a lower level than on the south of it by about 1500 feet (see Plate VI., Fig. 4).

Again, the surface of the limestone country at Ashbrook, near Ballyshannon, on the north side of the fault, stands at 150 feet above the sea, and on the south side of it, the trigonometrical point on the "Ordnance Map" is 1712 feet on Dartry mountain, making here, near the meridian of Bundoran, a horizontal difference of 1562 feet, or a real difference in the amount of the fault of more; taking into account the amount gained by the dip, which, as at Lough Erne, is southward all through. This fact between Ashbrook and Dartry, on the upper surface of the limestone, affords a corroboration as to the amount of the fault, of the case, at Portinode and Shean Hill, both on the millstone grit.

In this particular fault, because it cuts through a formation, the beds of which are all parallel, there is provided at one side of it a duplicate for every band of rock on the other, though those duplicates occur on levels far different; and since there are in the district four distinct bands of the Carboniferous formation, that is, millstone grit, limestone, Carboniferous Slate, and Old Red Sandstone, so there are in the vicinity of the fault two millstone grits, two limestones, two Carboniferous Slates, and two Old Red Sandstones; but I need scarcely repeat that every duplicate band on the low, is also an equivalent of the corresponding band on the high, side.

Although there is no geological fact in the west of Ireland more palpable than this, that the base of the millstone grit to the north of Lough Erne, near Pettigo, stands on a level 1000 feet lower than at Shean Hill, on the south of it, yet this fact seems altogether to have escaped

Mr. Griffith's observation. Had he noticed this feature, he would have been able to account in another way for limestone occurring on a low level at Ballyshannon, and high at Dartry mountain, without calling the first lower limestone, and the second upper; thus making two bands where there is actually but one, and, filling up the intermediate space with an imaginary creation, a band of calp 1700 feet thick, giving it a false position and a technical name. He would have seen that there is no more reason for those upper and lower limestones than there is for the millstone grit at Pettigo and that on Shean Hill being called lower and upper millstone grits. In both cases they are geological equivalents, or dislocated portions of the same groups of beds.

It so happens in the vicinity of Bundoran that the two Carboniferous Slates, with the upper part of the Old Red Sandstone between them, come in contact at the surface, partly by ordinary succession, and partly by juxtaposition (see Plate VI., Fig. 5). These three bands, in the position in which they occur, appear to have suggested the origin of the calp, that is, two bands of black shale with a band of sandstone between them, as described at the quotation No. 7, and shown on the explanatory sections on the large and small "Geological Maps." Be it remembered that those three bands do not occur in any vertical section. They are spread out over about two miles of ground. The two upper bands are in succession, as in all other places. The eastern band of Carboniferous Slate is not another band, but the equivalent of the western, separated by dislocation.

From these statements it will be seen that by my interpretation of the facts visible about Ballyshannon and Bundoran, Mr. Griffith has mistaken the succession in the stronghold of his calp; and, if my views be correct, the whole band of 1700 feet in thickness must vanish, and be distributed to other divisions of the formation.

It might be supposed that nothing but the most undeniable testimony would be put forward as a basis for a new band or subdivision of a rock formation, and that when this band of Calp, which was not known in the world before, was stated to exist between two limestones, there ought to be a reference made to some place where such band might be seen in its natural position, with the limestone above and below it in direct contact, and in a section which could not be disputed. Such a sight is nowhere in Ireland to be found,—where there is lower limestone, there is no upper in the same section; where there is upper, there is no lower. There is no lithological mark in colour or texture by which the volume of the lower can be known from the upper. The fossils are the same in both. In fact, the two are similar in every respect, and were once joined and continuous in the same band, though now separated from each other in some localities by dislocation, to the amount of 1500 or 1800 feet in difference of level.

If geologists who may hereafter examine this district should think my views correct, I need say no more about the calp, as this is the locality in which the idea of its existence, as a geological subdivision of the Limestone originated, as stated in the quotation No. 7; and if it be not here, it is not anywhere. The sandstone at Bundoran I take to be the Old Red, and the black slate, on both sides of it, the Carboniferous Slate in position, as I have described, and the geological place of all below the limestone.*

The sandstones of the other calp districts of Ireland are not Old Red Sandstone, but the sandstones of the Coal series. As, to show this, depends on arguments which constitute a different kind of proof from those just advanced of the truth of the views I take, I shall, therefore, proceed to notice them.

To the west of Lough Erne a calp sandstone is shown on the "Map" in a band of irregular breadth, from Churchhill, by Derrygonnelly, to

* Strangers reading this paper may ask, who is this that has written a paper against Mr. Griffith's views on the Geology of Ireland? Some obscure individual against a man of European reputation! For the information of such, I shall state a few facts:—I spent nearly the whole of the business-part of my life in Mr. Griffith's employment. I engaged with him in the spring of 1814. He was then Mining Engineer to the Dublin Society. The first work I did for him was to copy the manuscript and assist in making the map and sections of the Leinster coal district, his own first "Geological Essay," which was then preparing for the Dublin Society for publication. For eight years afterwards I accompanied him, a part of each year, in his geological excursions, surveying, drawing maps, and tracing rock boundaries, drawing diagrams, and making mining models for his lectures. We began, in 1816, a section across Ireland, beginning with the Mourne mountains, and ending at the sea near Sligo. The heights were measured with barometers. He met with an accident, which disabled him, about the middle of this journey, and had to stop at Castlesaunderson, and I continued the section alone. In 1822, when he was appointed, by the Lord Lieutenant, Civil Engineer over the south of Ireland, I assisted—surveying,

Lisbofin, near Enniskillen. This is Old Red Sandstone, the equivalent, and in exactly similar circumstances, with that at Bundoran, being thrown up by dislocation, or the adjacent limestone let down, and the two put in juxtaposition with each other by a fault along the eastern border of the sandstone, which has an approximate parallelism with the adjacent shore of Lough Erne.

Knockninny, a high, insulated, limestone hill, on the west side of Upper Lough Erne, rests also on calp sandstone, which appears at its western base, as shown on the "Geological Map." This is probably a continuation of the Derrygonnelly band, and, like that, the equivalent of the Bundoran sandstone.

Although these three sandstones are detached, the limestone which lies above them forms to the eye a continuous range of precipices, beginning at Knockninny, and proceeding by Ben Naghlin, Florence Court, Belmore mountain, Knockmore, Shean, Dartrey, and Truskmore mountains, to Benbulben and the vicinity of Sligo. There is no mistaking the limestone in this mountain group, for it may be traced by the eye for miles before the traveller in the precipitous cliffs which abound along this line, almost without interruption. The sandstones just alluded to, though detached from each other, being at a fixed distance below the limestone, the strata of both being parallel, their true relative position also becomes known.

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estimating, and marking out new lines of road, then completing some of them, and building the bridges; and here the knowledge I had acquired of Geology was important, enabling me, by following the strike and outcrop of the bed of rock, to discover many useful quarries, in places covered with bog or drift, where they were not known before. In 1830 I was transferred to the General Valuation of Ireland, then commencing. In this work I was every day on strange ground; marked the kinds and dips of the rocks on the maps I was using; and from this to 1850 I visited every barony in the three northern provinces of Ireland; I collected fossils in about 300 localities; I was at Bundoran, a place which is the subject of dispute in this paper, for several days. Mr. Griffith and I were there together one day. I showed him much of what I had previously observed; but he had not time to see all. If experience be useful, I had the best of it here, for I was as many days in it as he was hours; and so in most other places in the north. My opportunity there was good, and my attention unremitting. To the Geological Society of Dublin is now due the credit of raking up errors that might have gone on to posterity uncorrected, or even unnoticed, but for them.

From much experience and observation, I have come to the conclusion that there is but one great group of beds of Limestone in Ireland. There are intercalations in it below of thin beds of shale and thin beds of limestone in the passage from the underlying Carboniferous Slate into the Limestone mass; and there are intercalations of a similar kind in the passage upwards from the Limestone into the Coal rocks in certain localities. But, as a general rule, I say, that in Monaghan, Cavan, Leitrim, and Sligo, in Clare, Kerry, and Cork, in Tipperary, Kilkenny, and Queen's County, there is but one band of Limestone.

The second district, marked on the "Map" as calp, has been called the Slievebeagh district. It is a band about eight miles wide, stretching in a south-western direction between Lough Neagh and Lough Erne, by Dungannon, Caledon, and Aughnacloy to Brookborough. On looking over a "General Geological Map of Great Britain and Ireland," it will be seen that this band is a continuation of the Carboniferous valley of the Forth and Clyde, in Scotland. A district of graywacke slate and grit bounds them on the south in both countries; and, though there are some exceptions, mica slate is the prevailing rock on the north all the way from Aberdeen to Ballyshannon.

This valley appears to have existed before the deposition of the Carboniferous formation, and was a natural depression, in which that formation was deposited. The S. W. strike of the valley of the Clyde is fair across the channel to the county of Antrim, where the Coal rocks reappear, and, no doubt, are under the Permian and chalk formations below the great basin of Lough Neagh. They emerge again at Coal Island, in Tyrone, and are produced thence in the same direction to Brookborough, filling up the hollow between Monaghan and Clogher. It would not require any great stretch of the imagination to follow this line to the black shales and sandstones of Slieve Rushen, near Swanlinbar, and the country about Lough Allen, called the Connaught Coal district, and to imagine them all at one time connected. No one will deny that the Coal districts of Great Britain—perhaps of Europe—were deposited at the same geological period, and under the same conditions.

On this account I may here observe, that it appears to me inconsistent with geological reasoning to suppose that any such great wedge of calp as that described between Bundoran and Drumahaire could have been deposited in one place, and no calp at all in another place, the two only a few miles distant, in any such general system of deposition.

From several considerations, I am of opinion that the Slievebeagh mountains, shown on the "Map" to represent calp, are of the Coal formation. The limestone at Monaghan dips north-west and at Clogher south-east under them (see Plate IX., Fig. 6); thus showing that the shales, sandstones, and ironstones of the Slievebeagh district rest on limestone in the same way as the shales, sandstones, and ironstones of the Castlecomer district does, or as the Munster and Connaught Coal districts do, or, as a part of the same band does, the Coal Island district near Dungannon.

Mr. Griffith says of this locality, at par. 9, that "the district of the Slievebeagh mountains has long been considered to belong to the true Coal formation, and sanguine expectations have been entertained of the discovery of workable beds of coal; but having ascertained that, in the order of succession, it forms a portion of the calp series, it appears very improbable that these expectations will be realized." Having a theory fixed in his mind that there must be a Lower and an Upper Limestone, with a band of calp between them, and finding in the Slievebeagh mountains that there is but one limestone, or that there is no Upper Limestone, he concludes, of course, consistently with his theory, that there was no coal which in position could only be found overlying that Upper Limestone.

It will be seen by reference to his "Report of the Tyrone Coal District," in the Table of "Strata," at p. 16, that the first bed of coal is 211 yards above the limestone at Drumglass, near Dungannon; and he shows, at p. 39, that in the immediate vicinity of Coal Island there are seven workable beds of coal, amounting to 34 feet in the aggregate thickness, and that all these beds are in 196 yards of thickness of the strata, from the lower bed of coal to the upper, or 407 yards from the limestone to the upper bed, including them all.

At Dungannon Mr. Griffith has drawn a line across the country to the north-west, marking the eastern boundary of the calp of the Slievebeagh district. On the east side of this line are limestones, shales, and sandstones; on the west side of it are similar limestones, shales, and sandstones. Thus the rocks are the same on both sides of the line, and there is no reason why a boundary line should be made at this point, only that coal has been worked on the east side, and no coal yet discovered on the west.

On this part of the subject it appears to me that the limestone at

Drumglass and the limestone at Monaghan are geological equivalents, and that the group of shales and sandstones which overlies the Drumglass limestone, and which contains the coal-beds, is the equivalent of the shales and sandstones of the Slievebeagh group, which may also contain coal. If there be 211 yards in thickness of shale and sandstone strata over the limestone in the Slievebeagh mountains, there should be as good a chance of getting the first or lowest bed of coal there as at Drumglass. I never examined the country in detail with a view to determine this thickness, and am, therefore, not competent to say whether coal is likely to be found there or not; but it depends on the thickness of the strata of this group existing above the limestone.

In corroboration of this view, I will state that Colonel Portlock, in his "Geological Survey of Tyrone," &c., made a large collection of fossils. A part of the collection is deposited in the Museum of Irish Industry at Stephen's-green. Among the plants are Stigmaria, Sigillaria, Lepidodendron, &c., from the coal districts of Ballycastle and Coal Island. Specimens of Stigmaria, as good as any of those, are to be seen there, from the sandstone of Carnteel, near Monaghan, eight miles to the south-west of Dungannon, in the middle of the country, coloured on the "Map" as calp. Colonel Portlock's survey appears to have ended before he got so far south as the Slievebeagh mountains. However, in spite of the boundary line drawn at Dungannon, coal plants have been found at both sides of it alike.

Mr. Griffith in his early life got imbued with a horror of the calp phantom, and in the reports he wrote on the subject of mining he warned proprietors to beware of trying for coal in the calp. In the Report of the Connaught Coal District, in a note at bottom of page 9, he says:—"Many fruitless trials have been made in search of coal in different parts of the calp country by ignorant miners, who mistook the black slate clay, with which it is interstratified, for the slate clay which forms a principal member in the coal series."

When a theorist once takes a certain view of a subject in geology, and wishes to make out something new, every fact that appears to support that view is greedily adopted and enlisted into the service, while the facts which tell against it are rejected. Since the period of the discovery of the calp sandstone at Bundoran by Mr. Griffith, every insulated patch of sandstone in Ireland associated with black shale, which is not clearly below the bottom or above the top of the limestone, has been called calp sandstone.

The two other calp districts alluded to, with this, comprise together between 1700 and 1800 square miles. This, instead of a barren calp, may possibly, at least a part of it, turn out to be a fertile coal district. I am not, however, so sanguine as to hope there may be coal in all this area: on the contrary, I know there is not; that a great part of it is the shale which forms the base of the Coal series, and has not sufficient thickness over the limestone to come up to the coal-beds; but, even if there were coal in one-tenth of the area, see what an effect it would have on the prosperity of Ireland. A square mile of coal, a yard thick, would yield above three millions of cubic yards.

At all events, the Slievebeagh district, being the geological continuation of the Glasgow valley, where thick and numerous beds of coal are worked, and those beds repeated in the small but rich colliery at Coal Island, in Tyrone, afford strong grounds to presume that there may be coal here, though not yet discovered. Whether or not, Mr. Griffith's opinion, as given above, and also at par. 9 of the quotations, emanating from so high an authority, if allowed to go forward to posterity without being contradicted or corrected, would be so far mischievous that it would have the effect, in all future time, of preventing any proprietor or geologist from even examining the district with a view to discover coal.

The Dublin calp district is the third in the list I have made; but, before entering into details regarding this, I shall make a few observations relating to the black shales which are associated with the Carboniferous rocks.

The Carboniferous Limestone of Ireland, in almost all places, has a blackish, shaly band immediately under it, which has been called Carboniferous Slate. It has also a black shale over it, called millstone grit, or the base of the coal shales. Those two black shales are different in character, and require each a short description, because, in the Dublin district especially, both of them occasionally take an important part in the supposed calp.

The lower shale, or Carboniferous Slate, consists of alternate beds of black shale and dark-gray limestone, the shale prevailing towards the base, and the limestone prevailing upwards, where the shaly beds become mere thin partings between the limestone beds, and then disappear altogether, the rock becoming a pure limestone. The limestone beds of this group are generally of a dark-gray colour, composed often of pure limestone, and filled with stems of Encrinites and other fossils. This whole band is generally highly fossiliferous, having corals and shells both in the limestone and in the shale or mud beds. This group is well exposed about the Martello Tower at Portmarnock, and thence along the shore to Malahide; also at Abbey Bay and Bundoran Bay, near Ballyshannon, as already noticed, and many other places. This description applies to the Carboniferous Slate almost everywhere.

The upper shale, or that which overlies the limestone, is not like the lower. Of this band there are three different types: one in the south of Ireland, in Munster, and Leinster; a second in the middle district, lying between Dublin and Galway, and a third in the north, in the province of Ulster.

In the southern type the black shale lies directly and abruptly on the gray limestone, without any passage from one into the other. It is well seen at Old Leighlin, near Carlow; at Abbeyleix; near Cashel and Killenaule, in Tipperary; at Kilfenora, in Clare; at Ballybunnion, in Kerry; at Foynes, in Limerick; and between Buttevant and Mallow, in Cork.

The second type is to be seen about Dublin, where there is a series of beds of two kinds of rock, alternating with each other—one a black, impure, argillaceous limestone; the other a black shale,—those alternations forming a passage from the gray, pure limestone into the coal shales above. This is well exhibited in the railway cutting between Inchicore and Hazelhatch, and also at Clontarf, both near Dublin; it is seen in a quarry at Malahow, two miles south-west of the Naul, in the north of the county; it is visible also, on the road side, one mile east of Balla, in the county of Mayo, where there is a similar passage from the limestone into the overlying coal shales of Slieve Corran, a millstone grit mountain.

In the northern type there are alternations of three kinds of rock,—limestone, shale, and sandstone,—and each of the three occurs both in the Old Red Sandstone and in the limestone. There is a good section in the cutting of the canal at Benburb, six miles north-west of Armagh, where there are three or four bands of sandstone, and as many of limestone and shale, in the passage from the main body of the limestone upwards.

In fossils there is a strongly marked difference between those two shales. In the lower group, or Carboniferous Slate, as said before, the thin beds of limestone are generally pure, and in both the limestone and the shale corals and shells are abundant, and of the kinds found in the limestone above; whereas, in the upper passage, in the middle district of Ireland especially, the beds of limestone are black, argillaceous, and impure, and neither those beds nor the shales, with which they are associated, contain any fossils, so far as I know. Above the passage, however, in the coal shales, fossils appear; but the fossil mollusca of those black mud beds are different from those that occur in the limestone. A few species of Posidonomya, of Goniatites, and of certain Pectens, all with wonderfully thin shells, as if they had lived in fresh water, are the prevailing kinds, and they are not abundant, except in the beds a short way above the limestone. They are found in the black shales on the shore of Lough Shinny, near Skerries; in the railway cutting at Baldongan, near Lusk; at Garristown, and at Walterstown, in Meath; and they are very fine at Corry, at the north end of Lough Allen, where the Shannon comes into it; also to the west of Inchiquin Lake, in Clare. I may add, that I never found a *Posidonomya Becheri*, nor a *Pecten papyraceus* in the Carboniferous Slate, though I searched that band well for fossils in above 150 localities in Ireland.

Of the three foregoing types of the passage from the limestone into the upper or coal shale, that one about Dublin is that with which I have most to do at present, because the typical rock is one of the members of the supposed calp.

It may be interesting to remark, that in England, at the passage from the limestone into the overlying coal rocks, there are three types corresponding to those in Ireland. In Derbyshire it is the same as in Kilkenny; in Lancashire, the same as in Dublin and Meath; and in the north of England and Scotland, the same as in Antrim, Tyrone, Monaghan, and Fermanagh. Those three types happen also, on both sides of the Irish Channel, to correspond in the general geological strike, and the rocks of Dublin are a continuation of the rocks of Lancashire, connected, too, by a link in the Isle of Man, all of the same type. These three English types are well described in Phillips's "Geology of York;"

paper on the subject is contained in the proceedings of the Geological Section C, page 88, of that year, to which I beg to refer. I have fortunately preserved the section* exhibited at the meeting, which shows the grounds on which my subdivisions of the Carboniferous System, as regards Ireland, were based.

This section exhibits the geological structure of the Carboniferous System for a distance of fifty miles, in an east and west direction, commencing in the Silurian strata near Butler's Bridge, in the county of Cavan, and extending westward by Belturbet to Slieve Rushen mountain, crossing Cuilcagh mountain, the valley of the Shannon, Lackagh, and Benbo mountains, and terminating on the sea-shore at the western base of Benbulben mountain.

In the neighbourhood of Butler's Bridge the Silurian strata are covered unconformably by strata of yellow sandstone, which are succeeded by a band of Carboniferous Slate, and afterwards by the Lower Limestone, which near Drummany Lough, two miles west of Belturbet, is succeeded by alternating beds of shale and impure limestone of the Calp series, together with gray and occasionally reddish sandstone. These strata extend westward from Drummany Lough, by Ballyconnell, to the base of Slieve Rushen, for a distance of about four miles, where they are succeeded by the gray splintery limestone (Upper Limestone) of Slieve Rushen, which in this locality is upwards of 400 feet in thickness. This limestone is capped on the summit of the mountain by sandstone belonging to the Millstone Grit series; descending to the westward, we lose the Millstone Grit, and the Upper Limestone appears again at the surface in the line of section; and further west we find the calp and shale cropping out from beneath it, and forming the valley of Swanlinbar, which is altogether composed of the Calp series; from whence it extends northward to Florence-court, where it terminates, and the subjacent Lower Limestone commences, and continues to Enniskillen. In a south-western direction from Swanlinbar the Calp extends to Ballinamore, in the county of Leitrim, where we again find the Lower Limestone cropping out from beneath it.

Here let us pause to consider the result of what has been shown.

* For a portion of the section alluded to above, as well as for others referred to in the following observations, see Plate X.

We find that to the east of Slieve Rushen the Calp series rests on the Lower Limestone at Drummany, and is covered by the Upper Limestone at Ballyconnell; again, in a north and south direction, at right angles to the section, we find that the Lower Limestone, extending southward from Enniskillen, is covered by calp and shale near Florence-court, from whence it continues, in a southward direction, to Ballinamore, where it rests on the Lower Limestone of the valley of Leitrim. In fact, the Upper Limestone of Slieve Rushen is entirely surrounded by the Calp series, which is itself surrounded by subjacent Lower Limestone, for a circumference of thirty-six miles: and thus in this case we have a succession of concentric circles, each surrounding the other, in an ascending order from the Lower Limestone by the Calp to the Upper Limestone, proving the triple subdivision of the Carboniferous Limestone System, as originally described by me, to be correct; and consequently Mr. Kelly's view that the Carboniferous Limestone of Ireland consists of one undivided series, based as it is on the occurrence of supposed faults, is erroneous and untenable. Continuing the section westward, the Calp of the valley of Swanlinbar is succeeded by the Upper Limestone of Cuilcagh mountain, which, as at Slieve Rushen, is capped by the Millstone Grit; and, still proceeding westward, the same series crosses the valley of Lough Allen by the source of the Shannon, and thence by Lugnaquilla and Lackagh mountains, each of which contains a bed of coal near the summit. To the west of Lackagh mountain the Upper Limestone crops out from beneath the Millstone Grit, and descends into the valley of Manorhamilton, where the Calp series is again well exposed, as well as a portion of the Lower Limestone, the remainder having been cut off by the protrusion of the granite ridge of Benbo mountain, but which, in continuation in a south-western direction, extends to Collooney, &c., in the county of Sligo, where it is fully developed.

To the westward of the Benbo ridge we have again the Upper Limestone, and beneath it, in the remarkable valley of Glencar, there is a fine exhibition of the calp and calp shale, which on the west side is again succeeded by the Upper (or splintery) Limestone of Benbulben. This rock forms the upper portion of this lofty mountain, the table summit of which is characteristic of the district.

Descending westward from Benbulben, we find the strata beneath the Upper Limestone to consist—first, of a series of beds of calp and shale, 800 feet in thickness, under which, for the first time in this line of section, we have a considerable development of gray sandstone, which in this locality extends down to the sea-shore, and beneath which, to the northward, there is a considerable thickness of beds, consisting of alternations of calp and shale, similar to those which lie above it. These strata are well exposed to view on the west coast of the counties of Sligo and Leitrim, extending northward for upwards of sixteen miles from Glencar, by Benbulben, to Dartree mountain, near Bundoran; thence for fifteen miles, in an eastern direction, by Garrison and Belleek, to Lower Lough Erne, and afterwards in a southern direction, for fourteen miles, from Churchill, by Derrygonnelly and Belmore mountain, to the Arney river, near Florence-court, where it gradually thins out. And thus we have a total length of thirty-five miles, in a northern, eastern, and southern direction, in which these remarkable sandstone and shale beds are fully exposed for examination to the geological observer.

In the line of section engraved on the western margin of the "Geological Map," which passes over the summit of Dartree mountain, at an elevation of 1712 feet above the level of the sea, and which extends northward to Ballyshannon, &c., we find that the Upper or splintery Limestone gives a thickness of 500 feet; the Upper Calp Shale beneath it, 500 feet; the subjacent sandstone beds, 800 feet; the Lower Calp Shale, 500 feet; and the Lower Limestone, extending northward from Bundoran to Ballyshannon, 600 feet, making a total thickness in this locality of 2900 feet, of which 1800 feet belong to the Calp series. But this is an unusual development, as in other cases the thickness does not exceed half that amount, the variation in this respect being caused by the gradual thinning out of one or more of the members, particularly of the sandstone, which at the opening of Glencar, at the southern base of Benbulben, commences in the form of a wedge, having shale and impure limestone beds both above and below, and gradually thickens as it extends northward; and a similar occurrence takes place near the southern termination of the Arney River. Thus the eastern escarpment of Glenkeel mountain, south of Derrygonnelly, and ten miles north of the Arney River, gives nearly a similar section to that of Dartree mountain, presenting the Upper Limestone, the Upper Calp, the Sandstone beds, the Lower Calp, and subjacent Lower Limestone at Ely Lodge, on Lough Erne. Here the Sandstone beds are of considerable thickness; but to the southward they gradually diminish, and, after passing the Arney River are no longer visible, having thinned out, as at Glencar, and are lost in the union of the Upper and Lower Calp series; and these united beds continue thence through Florence-court to the valley of Swanlinbar, in which no beds of sandstone have been observed.

The variable thickness of the sandstone beds and their general fugitive character are familiar to geological observers; but the facts here related afford a remarkable example.

On the margin of the last edition of my large "Geological Map of Ireland" I have given a section which exhibits the entire suite of the Carboniferous System of Ireland, and which passes through the larger portion of the same district, but nearly at right angles to that exhibited at Liverpool, which I have just described. This section was exhibited at the meeting of the British Association held at Manchester in the year 1842, and it clearly shows the relative positions of the different members of the series; and it is the accuracy of this section which is endeavovred to be impugned by Mr. John Kelly, who conceives that the shales and sandstones, as there represented by me as belonging to the Calp series, really belong to the Old Red Sandstone, and the equivocal position in which the strata occur is accounted for by him by a great east and west fault, extending from the north-west end of Lough Erne to the sea-coast south of Bundoran, in the county of Donegal. But there are no grounds for this supposition. No doubt there is a fault, of trifling character, having a *north and south* direction, visible near the coast south of Bundoran; but in this case the strata, on both sides, belong to the same Calp series, as described by me, while its north and south direction contributes nothing towards sustaining Mr. Kelly's assumption of the great fault extending westward from Lough Erne to the sea-coast near Bundoran; and the only argument he has brought forward in support of his opinion is, that the level of the millstone grit at Shean Hill, on the south side of Lough Erne, is 1135 feet above the sea, while the millstone grit on the north shore of Lough Erne is only 150 feet above the sea; and, arguing on this difference of 985 feet, he assumes that a downthrow of about 1000 feet has taken place between the north and south shores of Lower Lough Erne. But Mr. Kelly's basis for the argument has no foundation, because the strata on the north shore of Lough Erne consist of yellow sandstone, and not of millstone grit. If Mr. Kelly has not himself examined this district with a view of ascertaining whether his fabric of faults was well founded, and if, in default of his own observations, he depended on published data supplied by me, he should have referred to the latest edition of my "Geological Map," or, indeed, to any publication of that document, even to the comparatively imperfect small one first published in the "Atlas" attached to the "Irish Railway Commissioners' Report," in which the country forming the north shore of Lower Lough Erne is represented as belonging to the Carboniferous Limestone series, and not to the millstone grit. No doubt in the printed geological "Outline" itself, owing to a want of accurate information at the time, and basing the supposition on the occurrence of a thin bed of coal, it is mentioned that a millstone grit district extended from Drumquin "*towards*" Lough Erne; but no just conclusion can be drawn that the expression "*towards* Lough Erne" has the signification of the expression "*to* Lough Erne;" and had Mr. Kelly examined any of my *published* Maps, he could not have fallen into error in this respect. But I must confess that it appears to me to be unusual as well as unaccountable that the data used by Mr. Kelly, in his endeavour to overthrow the system of geological classification adopted by me, should have been derived, not from any of my more recent publications, but from a hasty "Outline," written nearly twenty years ago. Should he not in such case have investigated in the field the grounds on which his theory of gigantic faults is based?

I will now refer to a paper read by me at the meeting of the British Association held at Cork in the year 1843, in which I described in detail the strata which occur on the north shore of Lower Lough Erne, extending in an eastern direction, an abstract of which will be found in the "Proceedings" of that year, Section C, page 42, from which I may quote the following:—

"Mr. Griffith next described the district situated to the north-east of Lough Erne, which contains a great variety of strata, belonging to the Carboniferous, the Silurian, and the Mica Schist Systems. The succession of the strata as they occur in this interesting district was exhibited in two sections, one of which extended from the Mica Schist District of the county of Donegal, north of Pettigo, across the limestone and sandstone valley of Pettigo, Kesh, and Ederney; it afterwards traverses the brownish-red conglomerate and sandstone district of Lisnarick and Irvinestown, and, in continuation, the dark-gray slate district of Lisbellaw, which contains Silurian fossils; from whence it is continued across the limestone valley of Brookborough, thence over the Slievebeagh mountains, and terminates in the graywacke slate district of the county of Monaghan,—thus exhibiting the structure of the country for a length of forty-two miles.

"Commencing at the northern extremity of this, the most southerly of these sections,—that near Pettigo,—we find the mica schist covered in an unconformable position by a bed of red conglomerate, about fifty feet in thickness, which is succeeded by beds of yellow sandstone, alternating with dark-gray shale, and occasional beds of dolomitic limestone. The shale contains the casts of plants, and also in abundance *Modiola Macadami*. These strata are about 150 feet in thickness. Above we have alternations of dark gray shale with occasional beds of gray sandstone, and a few beds of calcareous clay ironstone, sixty feet thick. This mass of shale and sandstone is succeeded by a series of beds of blue limestone, occasionally alternating with dark gray shale and yellowish-gray sandstone, 500 feet in thickness. It is remarkable that a thin bed of coal, half an inch thick, is included between two of the limestone beds at the base of this division. The limestone is frequently dolomitic, and, as is usual in such cases, fossils are of rare occurrence. Above we have a succession of beds, consisting of alternations of limestone and dolomite, about 100 feet in thickness, followed by alternations of dark gray, impure limestone, and black and gray shale, 300 feet thick, on the top of which we have beds of gray siliceous limestone, about sixty feet in thickness. These calcareous strata are succeeded by a great accumulation of beds, consisting of gray sandstone and shale; in some places the sandstone, and in others the shale, predominates, the whole being interspersed with occasional beds of impure limestone, amounting altogether to a thickness of about 700 feet. The shale contains in abundance *Modiola Macadami*, and the usual fossils belonging to the shale beds.

"These strata are followed by others very similar in character, excepting that the sandstone rather predominates. In the lands of Formil, close to the village of Tubbermore, a bed of highly carbonaceous shale, with two inches of bituminous coal, occurs in the sandstone. The shales produce the same Modiolas, Pectens, &c., as those lower in the series; but on the lands of Drumcurren, on the left bank of the river Banagh, numerous casts of the scales of *Holoptychius Portlockii*, accompanied by a single specimen of Pœcilodus, occur; also plants identical with those of Kilcummin Head, particularly the *Sphenopteris linearis*, and a small-leaved plant, apparently a fucoid.

"Above the fish-scales, and approaching the great or Lower Limestone, the shales were found to contain fossils indicative of the Carboniferous Slate; but owing to the unusual abundance of sandstone which accompanies the shale, it is difficult in this locality to draw with certainty the line of separation between the Carboniferous Slate, or Lower Limestone shale, and the Yellow Sandstone. The thickness of this upper portion of the series may be about 1200 feet: thus making the whole series, including the Yellow Sandstone and Carboniferous Slate, about 2900 feet in thickness. To the east of the village of Kesh and Ederny, Carboniferous Slate is succeeded by the Lower Limestone, the thickness being about 700 feet, and this again by the calp shale and calp sandstone."

I shall not dwell longer on this part of the subject, further than to state, that in no part of Ireland is the entire suite of the Carboniferous system so well or so clearly developed as in the formation surrounding the Connaught millstone grit district, situated in the counties of Leitrim, Roscommon, Sligo, and Fermanagh; and, as a convincing proof of the accuracy of my section through this district, as shown in the section engraved in the margin of my "Geological Map," I shall now exhibit a section on a larger scale, carefully made, in which the succession is perfect, and where the actual contacts have been carefully observed, and in which line no important fault has been discovered, nor can such exist. This section, in fact, forms a portion, though it has not been taken in the precise line, of that engraved on the margin of the "Map." Commencing in the Millstone Grit series of Dartree mountain, it extends, in a north-western direction, to the metamorphic Mica Schist, situate to the east of Ballyshannon, and in continuation still in a north-western direction; leaving the Mica Schist, the section crosses the Lower Limestone, which is again succeeded by the lower calp shale, which in this case, as at the base of Dartree mountain, is followed by the calp sandstone of Kilbarron, the contacts of the different series of rocks having been in each case accurately observed.

Mr. Kelly in his paper describes the Slievebeagh mountains, which occupy the northern portion of the county of Monaghan, and south of the county of Tyrone, as belonging to the Millstone Grit series, in consequence of the strata resting on limestone, and consisting at the base of alternations of impure limestone, succeeded by beds of sandstone; and he supports his view by the statement that the strike of this mountain ridge is parallel to the strike of the Coal series of the west of Scotland; but he appears never to have reflected that the Lower Limestone, which supports his supposed millstone grit to the south of Lisnaskea, in the county of Fermanagh, also supports similar strata to the west of Lough Erne, which, as already mentioned, are succeeded by the Upper Limestone and the Millstone Grit of Slieve Rushen mountain,—the breadth of the subjacent Lower Limestone between the calp of Lisnaskea and that at the base of Slieve Rushen being but three miles, as may be seen by reference to the "Geological Map." But I feel certain that no geologist, who has examined the country, will agree with Mr. John Kelly in regard to the geological position of the Slievebeagh mountains, but will decide with me that it is rightly referred to the Calp series.

I shall now exhibit a section extending, in a south-eastern direction, from the Silurian strata at Lisbellaw, in the county of Fermanagh, across the Lower Limestone valley of Clogher, thence over the Slievebeagh mountains, which, in continuation, crossing the Lower Limestone valley of Monaghan, terminates in the Silurian strata of Scot's-house, west of the town of Monaghan.

This section, in fact, forms the continuation of the section already described at the meeting of the British Association held at Cork in the year 1842; and I shall quote from the abstract of my paper which refers to the Slievebeagh section:—

"At Lisbellaw the Silurian rocks are succeeded unconformably by strata belonging to the Yellow Sandstone series, which is here very imperfectly developed, owing probably to its being cut through by the projection through it of the Silurian series. The Yellow Sandstone is followed by the Carboniferous Slate, and this again by the Lower Limestone, and, in continuation, by the calp and calp sandstone of the Slievebeagh mountains, from beneath which, in an eastern direction, we find the Lower Limestone and Carboniferous Slate appearing at the surface in the valley of Monaghan, and terminating unconformably on the graywacke slate, which bounds that valley to the south-east."

I shall not enter into any description in regard to the several other Calp districts laid down in my "Geological Map," as I know that the greater number of them have been examined by several distinguished geologists belonging to our Society; and I shall leave it in their hands to decide between Mr. Kelly and myself. But as I am not aware that and in the middle type he not only describes accurately the passage from the limestone into the overlying coal shales, but the country afforded him opportunities of giving actual measurements of the thicknesses of the alternating bands of shale and black limestone in several sections. Such opportunities, however, do not offer in Dublin, as the country is low, flat, much broken up by faults, and covered with drift.

With the Dublin district I begin by stating that there is a detached patch of the bottom of the coal shales at Kiltegan, about a mile northwards from Clonmel. To the south and south-west of Fethard, at Barretstown and Gurrane, there are two of the same kind; east of Cashel are two more of a similar kind; then comes the Killenaule coal district and the Castlecomer coal district. All these belong to the Coal series, and rest directly upon gray limestone. I refer to them for the purpose of showing that, with the exception of the passage beds at the top of the limestone, the upper shales of Dublin are precisely similar in position, as they are in character, with those coal shales in the south; and the shales in the counties of Kildare, Meath, and Westmeath, coloured on the "Map" as calp, the same.

Those detached patches in Tipperary bear evidence that denudation to a great amount took place over the face of the country, for, being next over the limestone, they are, of course, as just stated, belonging to the very bottom of the coal shales, the upper part having been carried away. In the north of the county of Dublin there is still a good thickness of those shales remaining—I should say, south of the Naul, 1100 or 1200 feet—and ironstones and sandstones, similar to those at Killenaule and Castlecomer accompany them. At Balrickard a gray sandstone was worked for the railway viaduct at Balbriggan. Sandstone occurs at Garristown; to the south-east of Slane is a band, coloured on the "Map" as calp sandstone, and another, similar, near Navan, and many smaller ones, as may be seen by reference to the "Geological Map."

While on this part of the subject I may mention that, when employed on public works in the south of Ireland, I opened dozens of quarries in the coal country about Abbeyfeale, to get sandstone for the bridges and retaining walls. I am well acquainted with their appearance. Some time ago I visited a sandstone quarry near Navan, opened for the use of a railway bridge at Beauparc, and there, at a glance, recognised the lithological character of the quarries at Abbeyfeale: the same in colour, in hardness, in black shale partings, and alternating beds—the same in everything.

For those who may wish to see a clear distinction between those lower and upper shales there is a good opportunity near Malahide. The Carboniferous Slate is seen dipping under the gray limestone, and both in contact at the Martello Tower of Portmarnock, proving it to be the band below the gray limestone of Dublin, which comes to the surface in many places. From Portmarnock to Malahide, on the sea-shore, is an excellent typical section of this band.

The upper or millstone grit band is seen in the railway cutting near Malahide, at the second viaduct south of the town, adjoining the demesne. About forty yards to the north of this viaduct there is a fault, visible in the cutting, on the north side of which is gray, hard limestone; on the south, black, soft shale (now called Calp), belonging to the coal shales. From the angle of the slope of this fault the geologist will infer that the black rock slipped down from a higher level. Here an instructive comparison may be made between the Carboniferous Slate at Portmarnock Martello Tower and the black shale at the viaduct. The rocks at this break are unconformable, for they dip nearly in opposite directions from the line of fracture. The Carboniferous Slate at the Tower contains beds of crystalline encrinital limestone, amounting in volume to about half the mass. The shale (Calp) at the viaduct has no limestone beds at all—not, I suppose, an ounce in a thousand tons of the mass. The contrast in fossils is this, that out of the 1050 species, exclusive of plants, got in the Carboniferous formations, the Carboniferous Slate contains nearly all the shells and corals found fossil in the limestone; while the shales above contain only from 3 to 4 per cent. of the entire number of the shells, and none at all of the corals.

I have just said that the coal shales contain about 3 or 4 per cent. of the fossils common to the limestone. This makes a pretty large number. I stated before, that there were but very few species common to the two. To explain this apparent discrepancy I will state, that in a ravine at Cahernanalt, two miles north-east of Keadue, in Roscommon, and about 150 feet above a bed of coal, I found a bed of black, calcareous shaly rock, about three feet thick, and in it I got a bag of fossils. These were examined by Mr. M'Coy, and he stated that out of 35 species obtained, 26 were common to the mountain limestone, and 9 either peculiar to the coal shales or new. I would enumerate them here; but my paper is getting long, and I may make them the subject of a future communication to this Society.

While on this point, I will further add, that those fossils found high up in the coal rocks, and the fossils before enumerated, found below in the Old Red Sandstone, which are in both cases common with those of the middle part (the limestone), show two strong links, made by nature, connecting the coal rocks, the limestone, and the Old Red Sandstone with one another into one formation inseparably, and putting them in the position in which they were placed by geologists about the year 1835.

If the rock called Calp of the Dublin district were a band made up of shale and sandstone, between two limestones, as represented in quotation No. 4, the Upper Limestone might be expected to appear in some part of this extensive district overlying the Calp band; but no limestone exists over this peculiar black shale anywhere in Dublin, Meath, or Westmeath. I have no doubt whatever that this whole district, coloured on the "Map" as calp, is of the Coal series. Every variety of sandstone, ironstone, shale, and fossil to be met with in it is identical with a variety to be seen in some or all of the coal-fields of Leinster, Munster, and Connaught.

The fourth Calp district shown on the "Map" is in the county of Galway. A straight line from Banagher to Monivea would pass nearly through the middle of it. This district occupies nearly 500 square miles. It is, like Dublin, low and flat, and mostly covered with drift. The substratum of the soil is formed mostly of strong clayey gravel, with pebbles of limestone. There is much bog, which lies on similar drift, in this district. Like that near Dublin, there is no section anywhere showing that any limestone overlies the black shale. In Galway it is the same as in Dublin—the base of the Coal series.

The question may naturally be asked here,—Is there any chance of finding coal in Galway? No one can answer this. While the Calp held its sway in the country, this idea could not be entertained; but if this myth should give way, men would begin to think about it. We find in Tipperary, about Fethard and Cashel, detached patches of the base of the coal shales, left on hills or on high grounds, where the limestone attains a good elevation, and it appears that on those high grounds denudation has swept away the greater part of those shales, but not the whole, as the Killenaule coal district, on high ground, still remains to testify. The land of the black shale in Galway is for the greater part in a low position, and now covered over with bog. It may have had more shelter or a greater depth of sea over it at the time the denuding agency was in operation, which would leave it less exposed to the action of that agency than the hills about Cashel, and, therefore, a chance that a considerable thickness of the strata may remain untouched,—thus affording grounds to suppose that coal may be found in Galway, in a low country at least, as well as at Killenaule on a high one.

I have thus noticed the four principal Calp districts, and shown, according to my interpretation, how they ought to be apportioned on the "Geological Map," or at least an approximation to it.

In addition to the objections already urged, it may be stated that there are many clear and satisfactory sections across the whole of the limestone in Ireland, from the Old Red Sandstone at its base to the coal shales above it, in which there is no trace of calp. I shall enumerate a few of the localities where those sections occur.

1. In the county of Clare, on the parallel of Corofin, the Old Red Sandstone occurs on the west side of the Derrybrian mountains; proceeding westwards from those mountains, the limestone is surmounted by the coal shales near Corofin. Here the succession is clear, the dip constant to the west, and the rock visible, indeed quite bare of drift in most part of the section, and there is no calp.

2. A similar section occurs near Ennis, some miles farther south, in which there is no calp.

3. In Limerick, from the Old Red Sandstone at Knockaderry, to the coal shales near Ardagh, there is no calp. In this part there appears on the "Geological Map" a narrow band of calp; but there is no sandstone in it, which is the main feature of the Calp district at Bundoran, as well as at Slievebeagh. This band vanishes on the "Map" towards Charleville.

4. In Kerry, from the Old Red Sandstone near the Causeway, by Lixnaw, to the coal shales on the south-east, at Crotto, there is no calp.

5. There is no calp near Tralee in the section from the Old Red Sandstone of Slievemish at Ballyseedy, across the limestone to the millstone grit, or rather the coal shales, near Oakpark.

6. In Cork, from the Old Red, at the south-west end of the Galtees, near Buttevant, to the coal shales near Mallow, there is no calp.

7. In Tipperary, in a section from the Old Red at Cahir to the millstone grit near Cashel, none.

8. In Wexford, though the coal shales do not appear at Hook Head, there is reason to believe that the limestone is visible, at least to very near its whole thickness. There is not any calp in the middle of it, that is, if calp consists of black shale and sandstone of the type imagined at Bundoran.

9. At Carlow, as stated by Mr. Griffith, at quotation No. 11, where there is a good section, the calp is wanting. In the Geological Survey, on the "Map" of Carlow, a thin band is shown as calp; but then it must be the black Carlow limestone flags, got a mile from the town, that are turned into calp. This band is one of the varieties of the limestone of which I mean to speak in the latter end of this paper.

10. From the Old Red Sandstone near Mountrath, in the Queen's County, to the coal shales at Ballyroan, there is no calp in the section.

Mr. Griffith himself may remember a time when he considered the shore all the way from Portmarnock to Malahide, in the county of Dublin, to have belonged to his calp. Such was the case when the "Synopsis of the Fossils of the Carboniferous Limestone of Ireland" was written by Mr. M'Coy; and it was a difference of opinion on this point that caused the localities of the fossils to be omitted in the printing of that work. He afterwards became convinced that that opinion was not tenable, and he put the Malahide shore into his Carboniferous Slate. I merely mention this to show that there did not from the beginning appear to be any certain marks by which the calp could be identified. The black shales below of the Carboniferous Slate were frequently confounded with the black shales above the limestone, and the sandstones below, of the Old Red, and the sandstones above, of the Coal series, when found in insulated patches, were often confounded with one another, and all those confounded shales and sandstones got the name of Calp.

Besides the four great Calp districts, there are some smaller ones shown on the "Map" of Ireland; but those are founded on the occurrence of some of the kinds of limestone, than which, perhaps, there is no rock which presents a greater variety of lithological character. In colour it is gray, of every shade, from nearly black to nearly white; it is sometimes quite black; it is blue, red, brown, mottled on a red or brown ground, with black spots; on a gray ground with large black or white spots, those spots sometimes hard at the edges, and sometimes softened. In grain it is very compact, with a conchoidal fracture. It is arenaceous, siliceous, argillaceous, splintery, crystalline. There are three or four varieties of grain and colour in one quarry at Merlin Park, near Galway.

I was at intervals, for many years, employed by Mr. Griffith at the "Geological Map." The Calp was always a special object of inquiry. About the middle of the limestone close search was made for a little black shale, or a few layers of flint, or a few beds of black or dull earthy limestone, which ought, according to the fixed notion, to be found thereabouts. Any little change of lithological character from the usual light gray type was welcome, and made a foundation for the band of Calp. In this way all the narrow bands were determined upon.

I shall consider one or two of those bands as examples:—say, first, that at the thin end of the great calp wedge already mentioned, a mile south of Drumahaire, in Leitrim. It proceeds from this place and passes immediately to the south of Markree Observatory; then gets very narrow at Killoran church, and continues on to the west of Tobercurry; from this place it turns eastward, by Carrowilkin, to Gorteen, and ends in a pretty broad expanse about Battlefield, to the west of Keshcorran mountain. I believe that in this whole dark-coloured band there is nothing but solid beds of limestone, and they are visible in it where the rock is not covered with drift, which is generally the case. Advantage appears to have been taken of the low situation and the covering of drift to introduce the Calp band along here, to give colour to the theory. The sandstone, which is so thick at Bundoran, is wholly absent, and the representation of the whole band here, fifty miles in length, as it appears on the "Map," is I believe a geological romance.

There is a band of Calp shown surrounding Slievecorran, to the east of Castlebar, which has a ramification to the east of Hollymount, and thence towards Mountbellew Bridge. This is another case founded upon change of lithological character in the limestone. But I need not further particularize those bands. If the Calp be not at Bundoran, as I said before, it is not anywhere, and all those small bands shown upon the "Map" must be swept away.

I have stated that there is a great variation in the lithological character of different parts of the Carboniferous Limestone. In the north of Ireland, about Cookstown and Stewartstown, and in the country on to Clogher, it is, perhaps, not more than from 100 to 200 feet thick. At Blackhead, in the county of Clare, immediately south of Galway Bay, there is a well developed and undisturbed section. Here there is about 1200 feet in thickness of it over water, and some more, buried in Galway Bay, not visible.

The general colour of the mass of the limestone is gray; towards the base it is dark-coloured; towards the top it is of a light-smoke gray. It may be of interest to notice some of the variations of character, and in doing so I shall take them in geographical order, beginning at Dublin, and proceed thence to the north, west, and south.

The county of Dublin is much broken up by faults, and it is impossible to trace the continuity of any band of rock for any considerable distance. One of those faults is visible in the railway cutting at Malahide, between the two bridges next the town. This fault has been already described. A similar fault occurs at Kennon Bridge, near Blanchardstown, in the cutting of the Royal Canal; but I need not enumerate more of them.

1. By means of those faults a certain band of light gray limestone comes to the surface in many detached places. In this the beds are thick and massive, and the stratification obscure. It is at Howth, Raheny, Coolock, St. Doulough's, Portmarnock Church, Carrick Hill, behind Malahide Castle, at Feltrim Hill, Clogran, Cappagh, in the cutting of the Royal Canal near Blanchardstown, at Castleknock, Woodlands, Hermitage, Curkeen, Milverton, Salmon, Oldtown, the Naul, and other places. The country generally between those quarries or hills of pure light gray limestone is covered by black shale, of which, in describing the upper shale connected with the limestone, I have spoken already.

2. Another type is seen in the dark gray and rather argillaceous thick beds, with partings of black shale, on the sea-shore near Malahide and at Swords. This is near the base, and associated with the Carboniferous Slate.

3. The dark gray, compact, close-grained limestone of Aclogh, near Hazelhatch, in Kildare, which is brought to Dublin to be burned, is a third type.

4. The light gray fossiliferous limestone at Millecent, near Sallins, in Kildare. This is much burned for lime in Dublin also. It is remarkable for the abundance of fossils, and particularly of Fenestella, it yields. It might be called the Fenestella limestone.

5. The limestone at Ardbraccan, in the County of Meath; altogether a crystalline gray mass, composed apparently of fragments of Encrinites. This type may be seen in the front of the Royal Dublin Society House, Kildare-street, Dublin, and it appears remarkable when viewed with a magnifier.

6. The red limestone at Castle Espie, near Comber, in the county of Down, is of another type. This band is low down in the Old Red Sandstone, but of course is a band of Carboniferous Limestone, since the Old Red itself in Ireland is a division of the Carboniferous formation; and to back this, the limestone contains some of the peculiar fossils.

7. At Armagh is a mottled marble, with a ground of brownish-red, with dark brown spots softened round the edges.

8. At Armagh there is also a brownish-gray marble, mottled with black spots.

The limestone of Armagh generally is of a yellowish-gray colour, with a tint of pink through it; and this colour prevails also about Cookstown, in Tyrone.

9. In the vicinity of Cookstown there is a peculiarity worthy of notice. The whole of the limestone at this place and on to Dungannon and Clogher, is much thinner than in the South of Ireland, as stated before. The old red sandstone near Cookstown contains thin bands of limestone, and the gray limestone in the country southwards, contains thin bands of whitish sandstone, as seen at the Rock quarries near Pomeroy, at Donaghrisk, and other places.

10. At Killymeal, near Dungannon, the limestone is of a dull dark gray colour, and argillaceous. The fossil shells it yields are generally of a pure white colour, and very perfect. It is one of the best localities in Ireland for getting Fenestella and other delicately marked corals.

11. At Monaghan the colour of the limestone is of light gray, and it is very siliceous. The Court-house stands on a band of this.

12. At Colooney, near Sligo, is a limestone nearly black; it is very fine-grained, compact, and has a conchoidal fracture. It appears as if it would yield a good hydraulic lime, or give a good polish as a marble.

13. There is a black oolitic limestone at Crosspatrick, near Killala, in Mayo. The old Abbey at Moyne is built of it.

14. There is black marble at Westport.

15. A very light gray oolitic limestone occurs in thin beds at Balla, in Mayo, near the top of the limestone, being covered there by the Coal series of Slievecorran: the thin flags of this limestone give a ringing metallic sound when struck with a hammer.

16. Dark gray marble, nearly black, with a few small white spots, is at Angliham, near Galway. Some slabs are got here with a black ground, having white corals (Syringopora) in radiating lines, which make a very pretty appearance when polished.

17. There is a gray marble at Merlin Park, near Galway, exactly similar to that called the half-moon beds at Raheendoran, near Carlow.

18. There is a light gray oolitic limestone at Toberory, near Tulsk in Roscommon, differing from the gray oolite at Balla in Mayo, in having thicker beds. This oolite contains the usual fossils of the limestone.

19. A grey oolite occurs at Edenderry, in the King's County, which is very massive, and in the quarries assumes a columnar aspect. A similar grey oolite is at Donaghmore, near Rathdowney, Queen's County. It is also at Doon, and at Rushhall, both in the neighbourhood of Borris-in-Ossory; but in those two latter localities it occurs in ordinary beds —the massive columnar appearance is wanting.

20. A light gray, thick-bedded, brittle limestone occurs at Moore, near Ballinasloe in Roscommon, almost composed of a minute coral like Stromatopora, which I think is undescribed. I distinguished this by the name of the Stromatopora limestone, and it occurs in many places in Ireland.

21. A brownish-red marble, mixed with gray spots, occurs at Ballymahon, in Westmeath.

22. At Clonmacnois, King's County, the marble has a gray ground with small white spots, the whole being a mass of Encrinite stems. Marble exactly similar in appearance and colour is got at Palliskenry in Limerick, and at Carrigaline in Cork.

23. At Clonony, near Ferbane, the marble is yellowish-brown, mottled with large gray brecciated spots, and mixed with small gray spots, fragments of Encrinites. Another variety at Clonony has a ground mottled gray and white, with large brecciated brown spots.

24. At Castletown, in Lower Ormond, Tipperary, is a marble mottled red and white; and one something similar occurs at Killarney, in which the red and white occur in stripes. The latter in a cross section resembles a fresh-cut slice of bacon.

25. A gray limestone occurs near Borrisokane in Tipperary, which, when struck, yields a metallic sound. A large piece gives out a deep tone, and a small piece a high note; a musical instrument might be made out of this. A similar limestone occurs in many other places.

26. Light gray limestone, with nodules and layers of chert, occurs near Abbeyleix, Queen's County, and generally round the Coal series of Castlecomer. Of this character are the upper beds of the limestone near the passage into the coal shales almost everywhere they occur along this junction.

27. The black marble near Kilkenny has white marks of fossils, Rhynconella, Cyathophyllum, &c.

28. Another variety at Kilkenny is black, with a few large white crescents. The workmen call this band the half-moon beds. The white crescent is a section of a Productus filled inside with calcareous spar.

29. To the west of the river Barrow, near Bagenalstown, in the railway cutting, there is black shale, interstratified with beds of encrinital crystalline limestone. This type is common near the bottom of the limestone. It is similar on the shore near Malahide; but this type must not be confounded with the passage above from the limestone into the coal rocks (the Calp of Dublin), the black limestone of which has neither crystal nor Encrinite.

30. At Bagenalstown, in the street, the limestone quarried for building is a dolomite nearly black.

31. At Limerick there is very black marble, with a few pure white spots. At Doneraile, a band exactly similar in appearance occurs. Black marble is also got at Tralee.

32. At Palliskenry, in Limerick, there is a reddish-brown marble, with small white spots, remains of Encrinites, in calcareous spar.

33. At Ballymacelligot, near Tralee, a hard, brittle, flinty slate is found, of peculiar type. It is quarried for repairing the roads.

34. At Churchtown, in Cork, the ground of the marble is brownish-red, of various shades, mottled with large, white, brecciated spots, and sprinkled with small ones. Here also is a gray marble, with large white brecciated spots.

35. At Mitchelstown is a marble with a black ground, and large white brecciated spots.

36. At Cork there is a marble having a red ground, with large white spots. Here also is another, mottled gray and white.

37. At Monkstown, near Cork, the marble has a brown ground, mottled with gray and white spots.

Dolomite, a variety of limestone, is only a condition of it induced by metamorphic action. It can scarcely be ranked among the varieties, for every part of the limestone has been alike affected by it. In the bottom, the calciferous slate on the shore immediately west of the pier at Howth is changed into a dolomitic condition. At the top, the limestone at the summit of Belmore mountain, in Fermanagh, is a Dolomite. The general colour of it is a yellowish-brown, but it varies. At Bagenalstown in Carlow it is quite black. It is extensive about Ballyshannon, in the vicinity of the hill of mica slate, which appears to have been protruded through the limestone there. It is usually found in connexion with, or in the vicinity of, great faults in the strata, and sometimes it is the matter which fills up a dyke. A case of this latter kind is observed on the shore, about a furlong north of the Martello Tower at Portmarnock, in the county of Dublin, where a distinct vertical dyke of this substance is protruded through ordinary limestone strata. Another appears at Dangan, on the shore a mile north of Rush, in this county also.

I have now brought my subject to a conclusion, and will only further say, that to Mr. Griffith we owe much. If another man had been employed in the public capacity that he filled in this country, we probably never would have the "Geological Map" of Ireland now before us; and though it has some faults to be corrected, yet it exists a monument of a great love for his favourite pursuit, joined to a good opportunity of carrying it into effect; and though I differ with him on the subject of this paper, we know that the education of men, and the means by which they attain their knowledge, are so very different that it is impossible they could all think alike.

On the Calp as a geological subdivision, or band of rock, I have not any of the writings of Professor Sedgwick or Sir Henry de la Beche, to quote in corroboration of my views, as I had when treating of the Devonian System, or the Old Red Sandstone of Herefordshire. The Calp has been written upon only by Mr. Griffith, and no views but his are yet published on the subject. There are, however, a few sentences in Professor Sedgwick's Introduction, already mentioned, which are so applicable to the present case that I shall quote them. He says:—

"In the progress of a rapidly advancing science, a great and good workman may make a great mistake; and if that mistake be largely adopted under the sanction of his name, so much the worse for himself. A bold generalization, ratified by a technical name, may have the promise of some endurance; for men hate to be dangling in doubt, and one who offers to the inquiring mind an apparent resting-place is sure of immediate favour. When a man has accepted a technical name, he never readily submits to the humiliation of parting with it; and he will often cling to names with more tenacity than he clings to principles, which he never, perhaps, examined for himself, or, it may be, never thoroughly comprehended.

"The truths of nature, however, are not things mutable, and dependent on popular voice; they are eternal. Physical mistakes, whether of classification and nomenclature, or of a false induction from facts imperfectly observed, may last their day, but that day cannot be long while the spirit of inquiry is alive among mankind, and they are awake to the power and sanctity of philosophic truth.

"The higher the authority from which an error is promulgated, the greater is the danger to science. If I differ from a fellow-labourer, the greatest respect I can pay him is to tell him, plainly and honestly, where I differ from him, and it is no mark of respect to merge plain truth in mealy-mouthed words of stupid and unmeaning courtesy."

With these views, though I undertook the task of writing this paper with reluctance, I thought it a duty to put forward the views I entertain on the subject of it; to record the convictions resulting from an amount of experience that falls to the lot of few; and to try to get corrected what I believe to be an error, by laying before this Society my reasons for that belief.

Fig 1.

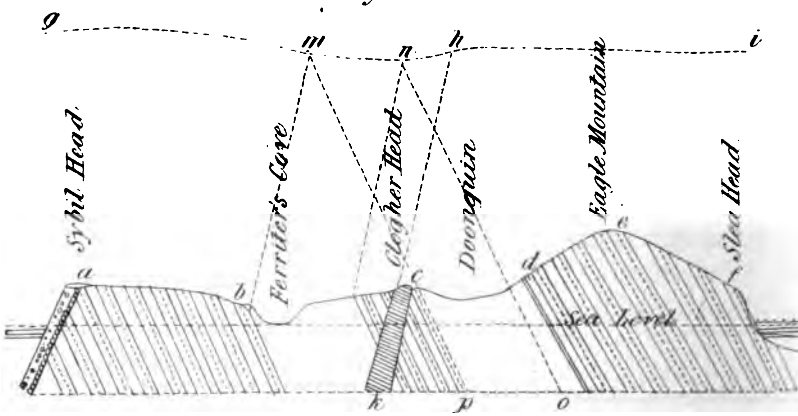
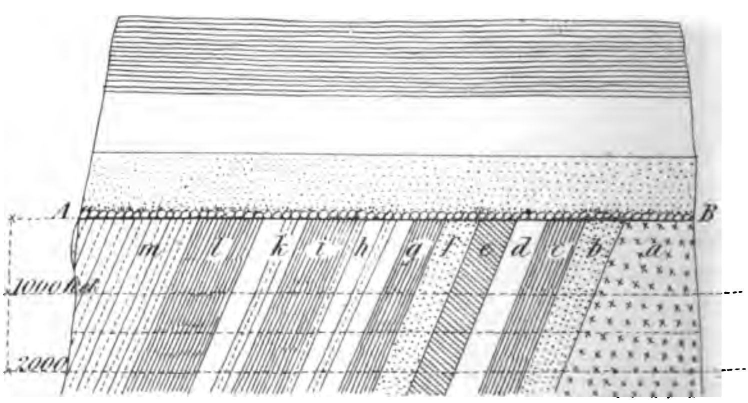


Fig 2.



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EXPLANATION OF PLATE VIII.

Fig. 1. *a*, a strong conglomerate at Sybil Head, about 60 feet thick; the base of the Carboniferous formation dipping N. W. 60° into the Atlantic, and lying unconformably on the ends of the brownstone strata from *a* to *b*.

g, m, n, h, i, supposed the original surface of the land.

m, n, o, p, a fossiliferous band of rock.

h, k, a supposed line of fault or slip.

c, k, a greenstone protrusion at Clogher Head.

b, k, the white part a fossiliferous band at Ferriter's Cove, supposed to have slipped down from the position *m, n*, on the line *h, k*, and to be the equivalent of *c, p, o, d*: a similar fossiliferous band at Doonquin Old Church; each band a part of the original *m, p, o, n*. See pp. 15, 16.

At *d* the lithograph is defective: the white between *d* and the line *n, o* should be shown as grit and slate, the same as between *d* and *e*.

Fig. 2. A, B, represents the Old Red Sandstone conglomerate; over it is the Old Red Sandstone, shown as dotted; next the Limestone, white; and lastly, the Coal Rocks, shaded with close horizontal lines.

a, Granite.
b, Stratified quartz rock.
c, Mica slate.
d, Primary crystalline limestone.
e, Greenstone.
f, Amorphous quartz rock.
g, Gray clay slate.
h, Gray grit.
i, Red clay slate.
k, Green grit.
l, Green chloritic slate.
m, Brownstone.

This plate is illustrative of a paper entitled "Researches among the Paleozoic Rocks of Ireland," by Mr. Kelly, for which see p. 116 of this volume.

EXPLANATION OF PLATE IX.*

Fig. 1. Sketch on the shore at Bundoran, at low water: *b*, *c*, *d*, a ravine; *c*, *e*, a vertical fault, having the dotted part *d*, Old Red Sandstone, on one side of it; the shaded part *b*, Carboniferous Slate, with fossils, on the other.

Fig. 2. Sketch of section at Kildoney, near Ballyshannon: the dotted part Old Red Sandstone, the other part limestone; *b*, *d*, a vertical fault between them, which brings the two rocks into juxtaposition at the surface.

Fig. 3. Sketch of section on the shore at Cultra, four miles N. E. of Belfast: from *a* to *b* red sandstone; from *b* to *c* gray and black shale, containing scales of Holoptychius and Paleoniscus, with Modiola, and others; *c*, *d*, red sandstone; *d*, *e*, yellow magnesian limestone; *e*, *f*, red sandstone; *f*, *g*, thin beds of bluish-gray limestone and red sandstone alternating; *g*, *h*, red sandstone. At *c*, *d*, *e*, *f*, *g*, whin dykes, generally vertical.

Fig. 4. Sketch section from Shean Hill, on the south, across a part of Lough Erne to Portinode, on the north: A, *a*, bands of millstone grit on the different sides of the fault *e*, *f*, and geological equivalents; B, *b*, limestone groups, and equivalents also; C, *c*, Carboniferous Slate, same; D, *d*, Old Red Sandstone, same; *g*, a talus of *debris* at base of cliff adjoining the fault; *h*, a part of Lough Erne.

Fig. 5. Sketch section near Bundoran, looking N. W.: *a*, band of millstone grit; *b*, limestone in Dartry mountain; *c*, Carboniferous slate, which lies in conformable succession on *d*, the upper part of the Old Red Sandstone, which here, as in most other places, is yellowish; *e*, Carboniferous Slate, separated from *d* by a fault; *f*, limestone at Finner Point, the junction with *e*, not clear, being covered with sand.

Fig. 6. Sketch section through the Slievebeagh mountains, from Monagh to near Clogher, looking westward: *a*, *b*, sandstones and shales of the Coal series alternating; *c*, Carboniferous Limestone; *d*, Carboniferous Slate; *e*, Old Red Sandstone; *f*, Graywacke, or gray clayslate and grit alternating; *g*, brown grit, with red and purple shales alternating, the grits resembling those near Ferriter's Cove, Dingle.

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* The references to Plate VI., in pages 238, 239, 243, and 244, should have been to Plate IX.

Fig 1

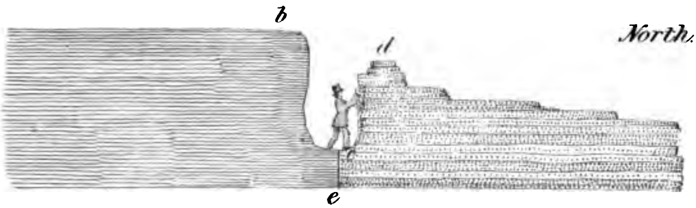


Fig 2.

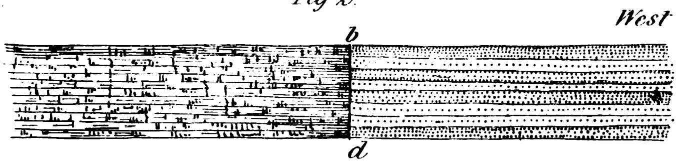


Fig 3

Fig 4.

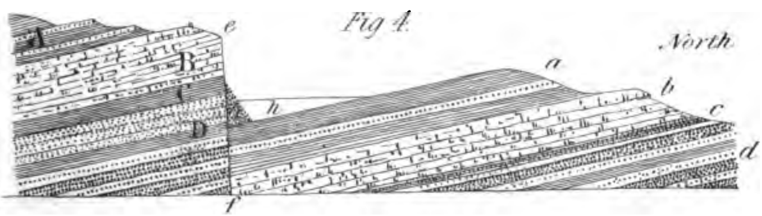


Fig 5.

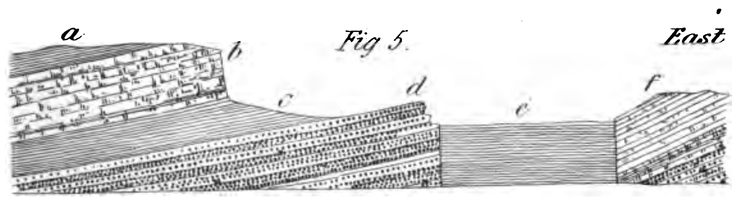


Fig 6.

Forster & C° lith.

WEDNESDAY EVENING, APRIL 8, 1857.

D. M'CAUSLAND, Esq., in the Chair.

DR. R. GRIFFITH read the following—

NOTES EXPLANATORY OF THE SUBDIVISIONS OF THE CARBONIFEROUS SYSTEM, AS LAID DOWN ON HIS LARGE "GEOLOGICAL MAP OF IRELAND," AND EXEMPLIFIED IN THE SECTIONS ENGRAVED ON THE MARGIN OF THAT MAP, AS ALSO IN OTHERS EXHIBITED AT SEVERAL MEETINGS OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, DURING THE LAST TWENTY YEARS.

IN the infancy of the science of Geology geologists were in the habit of grouping rocks which presented some character or characters which were common to all the members of a general system. Thus my lamented friend, Greenough, in the first edition of his "Geological Map of England," coloured the entire Carboniferous System of England with a light shade of black; but as careful and minute observation extended, he found it necessary to subdivide the system into four members, namely, Lower Limestone, Upper Limestone, Millstone Grit, and Coal.

A similar process gradually took place in the colouring of my "Geological Map of Ireland," the first outline of which was exhibited by me in the year 1813; and these gradual changes have not been confined to the Carboniferous, but extended gradually to the older sedimentary as well as the igneous rocks, each being introduced so as to correspond with the development of geological science, much exertion having been made by me to keep pace with modern discoveries and views, and with subdivisions based as well on stratigraphical as on palæontological data; and although in some localities the accuracy of the lines of division adopted by me, particularly those between the Old Red Sandstone and the Yellow Sandstone in the north, and between the Silurian and the Old Red Sandstone in the counties of Cork and Kerry, may be liable to further consideration, and perhaps may still admit of modifications in doubtful cases, I have yet the satisfaction of believing that the last edition of my "Geological Map" corresponds with the views generally entertained by our most accomplished and experienced practical geologists.

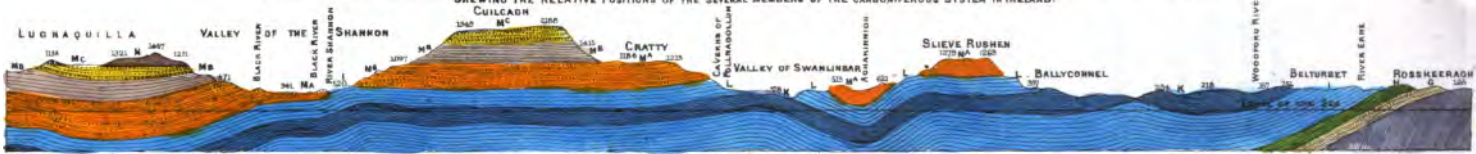
This short history of my geological proceedings is made at the present time in consequence of the paper read by Mr. John Kelly at the meetings of the Society for the months of January and March, in which he endeavours to impugn the accuracy of the subdivision of the Carboniferous System of Ireland which has been adopted by me for upwards of twenty years.

Previously to that period, in conformity with the principle adopted by Mr. Greenough and others, the Carboniferous System of Ireland was represented on my "Geological Map" by two colours,—blue and black,—the first representing the limestone, and the black the Coal series; but during the progress of my geological observations, made as opportunity offered in every part of the country, I found that, although my original views were correct in the gross, they were liable to objection in detail, inasmuch as many localities, represented by the blue colour as limestone, rarely contained any calcareous rocks sufficiently pure to produce caustic lime when burned, which is the agricultural test of limestone; and, as several landed proprietors complained of my want of accuracy in this respect, I determined to subdivide the System, so as to distinguish the shales and sandstones where each occur; and I have in consequence introduced the Yellow Sandstone and Carboniferous Slate, forming the lowest members of the series, and the Calp, which is interposed between the Lower and Upper Limestone.

In the paper just alluded to Mr. Kelly gives it as his opinion, that the Carboniferous Limestone of Ireland consists of one uninterrupted accumulation of limestone beds, interposed between the Carboniferous Slate at the base and the Millstone Grit at the top, and that my subdivisions of the Limestone series into three, viz., the Upper and Lower Limestone, with an intermediate series, consisting of dark-gray shale, impure limestone, and occasionally sandstone, called Calp, is erroneous; and that no such middle term exists in Ireland or elsewhere. This is a bold assertion; but by reference to plans and sections, carefully made, I have no doubt of being able to prove that Mr. Kelly is in error, and that my views, as shown in the last edition of my large "Geological Map of Ireland," are correct.

This triple division of the Carboniferous Limestone was first published by me at the meeting of the British Association for the Advancement of Science, held at Liverpool, in the year 1837; and an abstract of my

SECTION ACROSS THE LUGNAQUILLA, CUILGAGH AND SLIEVE RUSHEN MOUNTAINS, TO ROSSKEERAGH NEAR BUTLER'S BRIDGE, IN THE COUNTY OF CAVAN,
SHEWING THE RELATIVE POSITIONS OF THE SEVERAL MEMBERS OF THE CARBONIFEROUS SYSTEM IN IRELAND.

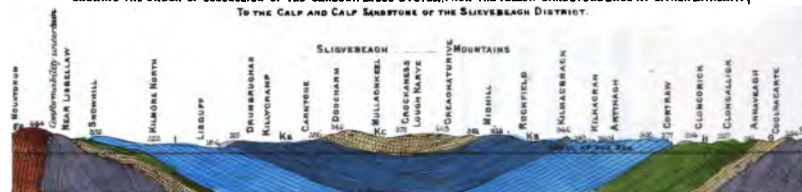


N. Coal. M. Millstone Grit divided into Mc Upper Sandstone Mb. Shale. Ma. Lower Sandstone. L. Upper or Splintery Limestone. K. Calp or Middle Limestone (beds of dark gray Shale and impure limestone) I. Lower Limestone.
H. Carboniferous Slate or Lower Limestone Shale. G. Yellow Sandstone. E. Silurian strata.

SECTION THROUGH THE YELLOW SANDSTONE DISTRICT NORTH OF LOUGH ERNE.
EXHIBITING A COMPLETE SEQUENCE OF THE SEVERAL MEMBERS OF THAT GROUP OF ROCKS,
SUCCEEDED CONFORMABLY BY THE LOWER LIMESTONE AND CALP SERIES.

Kc. Calp Sandstone. Kb. Calp or Middle Limestone, (beds of dark gray shale and impure limestone.) I. Lower Limestone. H. Carboniferous Slate or Lower Limestone Shale. Gcc. Yellow Sandstone and Shale with a thin bed (a) of impure coal. Gc. Arenaceous Shale. Gb. Arenaceous Limestone. Ga. Yellow Sandstone. Fc. Old Red conglomerate. Fb. Old Red conglomerate? Silurian Strata. A. Mica Schist.

SECTION FROM THE LOWER SILURIAN STRATA AT LISBELLAW, TO THE SAME SERIES OF ROCKS NEAR SCOT'S HOUSE IN MONAGHAN,
SHEWING THE ORDER OF SUCCESSION OF THE CARBONIFEROUS SYSTEM, FROM THE YELLOW SANDSTONE BASE AT EITHER EXTREMITY,
TO THE CALP AND CALP SANDSTONE OF THE SLIEVEBEAGH DISTRICT.



Kc. Calp Sandstone. Kb. Calp or Middle Limestone (beds of dark gray shale and impure limestone.)
I. Lower Limestone. H. Carboniferous Slate or Lower Limestone
Shale. G. Yellow Sandstone. Fb. Old Red Conglomerate? Silurian strata.
Eb. Fossiliferous Silurian Rocks.
Ea. Silurian Slate.

SECTION FROM THE CULM BEDS NEAR LOCHILL IN THE MUNSTER COAL DISTRICT,
TO SHANNON GROVE NEAR PALLASKENRY, IN THE COUNTY OF LIMERICK,
SHEWING THE RELATIVE POSITIONS OF THE SEVERAL MEMBERS,
OF THE CARBONIFEROUS SYSTEM IN THE SOUTH OF IRELAND.

N. Coal (anthracite) L. Upper or splintery Limestone. K. Calp or Middle Limestone (beds of dark gray shale and impure limestone.)
I. Lower Limestone. H. Carboniferous Slate or Lower Limestone Shale.
G. Yellow Sandstone.
F. Old Red sandstone, shale and ...

— HORIZONTAL SCALE FOUR MILES TO AN INCH. —

— VERTICAL SCALE ONE MILE TO AN INCH. —

July 1857

any of them have as yet had an opportunity of examining in any detail the Carboniferous System of the counties of Donegal, Cavan, Fermanagh, Leitrim, Sligo, and Roscommon, I thought it desirable to make this short communication in reference to that district.

I shall only further remark, in regard to the Carboniferous System of the south of Ireland, where the Calp is frequently wanting, that it is well developed in the county of Limerick, along the eastern boundary of the great Millstone Grit district of Munster, and I have prepared a section of the series, extending from the Old Red Sandstone of Pallaskenry, on the south side of the river Shannon, in a western direction, to the anthracite beds south of Loughill, in which the entire suite of rocks into which I have subdivided the Carboniferous System are clearly exhibited, namely, the Yellow Sandstone resting conformably on the Old Red Sandstone, the Carboniferous Slate, or Lower Limestone shale, the Lower Limestone, the Calp, and the Upper Limestone, the last being again succeeded by the Millstone Grit, which in this locality contains thin beds of anthracite; and I may mention, that in this section the Calp series consists, as usual, of alternations of blackish-gray, impure siliceo-argillaceous limestone, and dark gray shale, the thickness being about 800 feet.

NOTES ON THE CALP OF KILKENNY AND LIMERICK. BY J. BEETE JUKES, M. A., F. R. S.

My friend, Mr. Kelly, having in his paper lately read before this Society thrown some doubts on the existence of the group of rocks known as the Calp, which occupies a conspicuous place in Mr. Griffith's Map, and is shown as a distinct division on the lately published Maps of the Geological Survey,—I feel compelled to offer a few observations respecting it. I do this the more readily as Mr. Kelly endeavoured to prove that what was called Calp was in reality Coal-measures,—an assertion which would have such mischievous practical consequences that it is necessary its error should be immediately pointed out.

The lower part of the great Carboniferous formation has several different types in different parts of the British Islands. In Ireland these different types are three, that, namely, of the south, that of the north, and that of the centre. In the extreme south, namely, in Waterford, Cork, and Kerry, the Carboniferous Limestone forms one group, having underneath it a set of rocks which have two very different types in two different districts, and over it a set of dark shales and olive-coloured sandstones, containing some thin beds of coal, and therefore called Coal-measures. In coming towards the north, namely, into Limerick on the one side, and Kilkenny on the other, it becomes possible to subdivide this single group of Carboniferous Limestone into three sub-groups, lower, middle, and upper,—the middle receiving the provincial term of Calp.

The sole invariable distinction on which this subdivision rests is one of colour,—the Calp in the districts above named being invariably dark-coloured, generally nearly or quite black; while the upper and lower limestones are commonly gray, sometimes dark gray, sometimes nearly white. This Calp, then, is a mere local subdivision depending on lithological distinctions, and is not to be looked at as a geological formation, the equivalents of which are to be sought in other localities, or to be determined by separate suites of fossils. Its dark colour seems to be the result chiefly of earthy, more or less carbonaceous, matter being mingled with the limestone, sometimes in such proportion as to preponderate over the calcareous matter, so much that the stone would be no longer fit for burning into lime; sometimes to such an extent as to become mere shale, and beds of dark shale are generally found in greater or less thickness alternating with the limestones throughout the Calp districts of Kilkenny and Limerick.

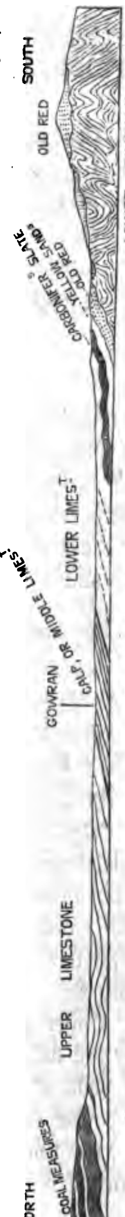
The occurrence of so much earthy sediment in the old seas, of course, was unfavourable to the life of the clear-sea-living animals, whose remains are found in the pure limestones; while other creatures who preferred a muddy sea, such as Posidonia, &c., inhabited it instead. Generally, however, the Calp is poor in fossils, though locally they do occur; and where the Calp is merely a dark limestone, I am not aware of its having any essential palæontological peculiarities—except paucity of fossils—different from those of the upper and lower limestones.

In the second Part of the sixth volume of our Journal, my former colleague, Mr. Andrew Wyley, has described the constitution of the Carboniferous formation of Kilkenny so accurately and well as to render it unnecessary for me to go over the same ground. I have only to say, that the one-inch maps of the district are now published, and to be had at Messrs. Hodges and Smith's; and to point to those on the wall, as presented to this Society by Sir R. I. Murchison on the part of her Majesty's Government; and also to the section through Gowran, which Mr. Du Noyer has constructed for me, from the six-inch data maps preserved in our office, in support of Mr. Wyley's conclusions. This section, however, would induce me to diminish the thickness assigned to the groups by Mr. Wyley, and to give the following as more probable :—

		Feet.
7.	Coal-measures, . . . upwards of	1000
6.	Upper Limestone, ...	1000
5.	Middle (or Calp) Limestone, . .	600
4.	Lower Limestone, ...	1000
3.	Lower Limestone Shale, or Carboniferous Slate, ...	150
2.	Upper Old Red Sandstone, or Yellow Sandstone, ...	250
1.	Lower Old Red Sandstone, . . .	300
	Total thickness, ...	4300

This thickness is one-third less than that given by Mr. Wyley in Nos. 4, 5, and 6, and two-thirds less in No. 3. As groups 1 and 2 are evidently thinning out towards the north, it is possible that group 3 is thinner in the above section than it is further south, where Mr. Wyley took his data from.

About eighty miles due west of Gowran is the village of Foynes, on the south bank of the Shannon, and in that neighbourhood the constitution of the Carboniferous formation is very similar to that of Kilkenny. The district is now being surveyed by Mr. G. H. Kinahan, and, although not yet complete, yet from an inspection of his work last week, and going over the ground together, we arrived at the following conclusions :—



Section No. 1.
Horizontal Scale, 1 m. = $\frac{5}{8}$ in. Vertical Scale, 1 m. = $1\frac{3}{8}$ in.

The Carboniferous formation on the south side of the Shannon, between Pallaskenry and Foynes, is composed as follows:—

		Feet.
6.	Coal-measures, ... upwards of	1000
5.	Upper Limestone, ...	250
4.	Middle dark Limestone and Shale (Calp), . . .	1400
3.	Lower Limestone, gray, ...	1500
2.	Lower Limestone Shale (Carboniferous Slate), . .	350
1.	Yellow Sandstone, ...	100
	Total thickness, ...	4600

1. Base not seen; yellowish grits and sandstones; sometimes calciferous, with a few reddish beds below: ascending, they alternate with beds of dark shale and compact limestone. Fossils, plant stems and fragments, Encrinite stems, *Modiola Macadami*, and other bivalves.

2. Black shales, sometimes calciferous, passing up into alternations of shale and argillaceous limestone; flaggy, and often nodular and concretionary. Fossils, fucoid beds, Michelinia and other corals, Encrinites, Fenestella, annelid tracks, Pecten, Spirifer, Producta, &c.

3. Lower Limestone.—Massive light-gray limestone, with, both at top and bottom, a purple band having red shale partings. The limestone much jointed; stratification often obliterated; bands of grey chert at base of group. Fossils very abundant; beautiful cephalopodous and other univalves in upper portions.

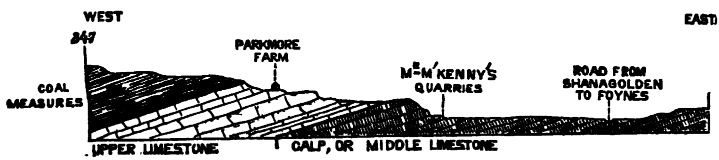
4. Calp Limestone.—Dark blue, sometimes black, compact limestone, with partings of dark shale, and thick beds of dark gray shale in lower portion; chert abundant throughout; bands and nodules of white chert at base; bands of black chert in other portions. Fossils, a few Productæ and Spirifers; Encrinite stems abundant in patches, occasionally Euomphalus, &c.

5. Upper Limestone.—Thin, flaggy, light-coloured limestones, nodular, and full of concretions of gray chert, on which rest a few very thick beds of massive pale-gray limestone, capped by thinner beds, which, near the top, are separated by seams of black shale, sometimes sandy, the limestones themselves becoming darker in colour. Fossils, Encrinites very abundant; Productæ, Spirifers, and some univalves.

6. Coal-measures.—Black indurated shale, passing up into alternations of dark shale with brown and olive-green fine-grained grits, the shale sometimes becoming purple. Fossils, *Pecten papyraceus*, Goniatites, &c., with coal plants higher up.

In one locality—townland of Lisgordan, N. of Cahermoyle—we procured beautiful seams of Wavellite in the shales near the base of No. 6.

Near Limerick, the beds of No. 4 greatly resemble those about Dublin ordinarily known as Calp. Towards the west these seem to become more purely calcareous, as they probably do also towards the south, so that, eventually, their distinctive characters become obliterated. Between Shanagolden and Foynes they may be distinctly seen to pass under the comparatively thin group of the upper Limestone, as in section No. 2.



Section No. 2.
Scale, vertical and horizontal, = 6 in. : 1 mile.

The thinning out of the Upper Limestone on the west side of the county of Limerick is very instructive, as suggesting the possibility of its thinning out altogether in some localities. Possibly this may be the true interpretation of the great thickness of the Calp of Dublin. It may be, that all the upper portion of the Carboniferous Limestone here assumes the Calp character, and that the Coal-measure shales would rest upon the Calp of the central counties of Ireland, without the intervention of any upper Limestone; or the upper Limestone may come in its true character, as a light-gray fossiliferous limestone, only in local patches, as suggested in the County or Index Geological Map of the county of Dublin.

WEDNESDAY EVENING, MAY 13, 1857.

PROFESSOR APJOHN, M.D., F.R.S., M.R.I.A., in the Chair.

REV. PROFESSOR HAUGHTON read the following paper—

ON THE SILICEO-FELSPATHIC ROCKS OF THE SOUTH OF IRELAND.

IT is well known that siliceo-felspathic trap rocks of a peculiar kind are found in the mining district of the Ovoca, county of Wicklow, and in the mining district of Bonmahon, in the south of the county of Waterford; and the recent investigations of the Geological Survey in the west of Kerry and Cork have brought to light the existence of great quantities of similar rocks in the neighbourhood of Killarney, and in the mountains to the westward stretching to the south of Kenmare Bay; and it is not at all improbable but that these remarkable felspathic rocks may in this district be associated with the copper lodes, which have proved so productive in the Berehaven or Allihies Mine. These rocks have a general resemblance to each other in all these districts, and when once seen and recognised, cannot be easily mistaken for any other description of rock; they are of a pale-bluish or greenish-gray colour, weathering white to the depth of several inches, slightly translucent on the edges, of conchoidal fracture, and sharp metallic ring under the hammer.

The Cornish miners who are acquainted with the mining districts of Wicklow and Waterford consider these rocks as the equivalents of their own Elvans, to which they bear no external resemblance, though it cannot be denied that they appear to exert an equally favourable influence on the productiveness of the metallic lodes with which they are associated; and the results of my analyses prove that they have an intimate relation to the granitic rocks in their chemical and mineralogical composition. The resemblance in composition to some varieties of granite is, indeed, so striking, that it requires but a slight effort of the imagination to conceive them as granites cooled under peculiar circumstances, which prevented the development of the usual crystalline structure.

In some cases, however, these siliceo-felspathic rocks appear to be deposited in stratified beds, conformable to the slates and felspathic ash-beds with which they are found associated. This is particularly the case in the Ovoca district, where the mass of felspathic rock is found to lie between dark soft slates of the Silurian age, and has never been observed to penetrate these slates in dykes.

I shall now proceed to the discussion of the analyses of these rocks from the Wicklow, Waterford, and Killarney districts respectively :—

1. *Siliceo-felspathic Rocks of the Vale of Ovoca, county of Wicklow.*

The cupriferous and pyritous lodes of this district have a N.E. and S.W. bearing, and an underlay to the S. E. They appear to be nearly conformable to the planes of bedding of the slate in which they occur; and they are overlaid to the S. E. by a thick mass of siliceo-felspathic rock, which rises into the remarkable hill called the Bell Rock, on the west side of the Ovoca. The lodes are all dislocated by a left-handed heave, coinciding apparently with the direction of the Ovoca Valley, and the felspathic rock partakes of this movement of the lodes. It has a stratified character throughout, and in places, as near the Tigroney Mine, it assumes completely the character of an ashy-slate, weathering perfectly white.

I obtained specimens of the Bell Rock from Mr. Edward Barnes, Resident Director of the Wicklow Copper-Mine Company, which were procured by blasting two or three feet into the rock, so as to obtain a portion quite free from the action of the weather. The specimens are of a pale-greenish colour, exceedingly hard, striking fire freely under the hammer; but, when subjected to long-continued action of the reducing flame of the blow-pipe, melting slightly on the edges, particularly in the neighbourhood of the minute specks of silicate of iron which appear here and there through the body of the rock.

The following analysis will serve to give an exact idea of the composition of this rock, which is more siliceous than the felstones of Waterford and Killarney :—

	Per cent.		Atoms.
Silica,	81·36	..	1·808
Alumina,	7·86	0·151	0·192
Peroxide of iron,	3·32	0·041	
Lime,	0·99	0·035	0·206
Magnesia,	0·45	0·022	
Potash,	3·09	0·065	
Soda,	2·63	0·084	
	99·70		

It is evident, from this analysis, that the atoms of protoxides and peroxides are about equal in quantity, and that the rock may be represented by a mixture of felspar and quartz :—

$$Q + F = 1{\cdot}808,$$
$$F = 0{\cdot}199.$$

From these equations we find that its mineralogical composition is as follows :—

	Per cent.
Quartz, ...	45·54
Orthoclase felspar, ...	54·16
	99·70

2. *Siliceo-felspathic Rocks of Knockmahon, county of Waterford.*

The felspathic rocks of Knockmahon are intimately associated with the copper lodes which have rendered that locality famous, and occur abundantly on the shore below the village of Bonmahon, in prismatic masses of a columnar structure, which have received the name of the Bishop's Library. These rocks occur also, and are well shown, in a cutting for a tram-road connecting Tankardstown with Knockmahon Mine. In this latter locality they occur stratified conformably with the brown fossiliferous Silurian slates which are found at the Tankardstown Mine. The following analysis is of a specimen taken from the stratified siliceo-felspathic rocks of the cutting of the tram-road :—

	Per cent.		Atoms.
Silica, ...	77·20	. .	1·715
Alumina, ...	6·54	0·126	0·199
Peroxide of iron, . . .	5·82	0·073	
Lime (carbonate), . . .	1·81		
Magnesia, ...	0·60	0·030	
Potash, ...	3·69	0·078	0·206
Soda, ...	3·03	0·098	
Water, ...	1·12		
	99·81		

This rock, like that at Ballymurtagh, county of Wicklow, is a compound of quartz and felspar. If it be regarded as a sedimentary rock, it must be considered as a trappean ash, composed of felspar and fine quartzose mud, with a slight admixture of carbonate of lime. Its mineralogical composition is as follows:—

	Per cent.
Quartz, ...	40·81
Orthoclase felspar, ...	57·19
Carbonate of lime, ...	1·81
	99·81

3. *Siliceo-felspathic Traps of Benaunmore, county of Kerry.*

The hornstones, or siliceo-felspathic rocks of Benaunmore, occur in splendid columns, many of which, as described by Mr. Foot, of the Geological survey, are 200 feet in length. The rock is more translucent than the felspathic traps of Wicklow or Waterford already described, and presents more of the character of a truly igneous product. Its analysis gave the following results:—

	Per cent.		Atoms.
Silica, ...	71·52	. .	1·554
Alumina, ...	12·24	0·238	0·277
Peroxide of iron, . . .	3·16	0·039	
Lime, ...	0·84	0·030	0·278
Magnesia, ...	0·39	0·019	
Potash, ...	5·65	0·120	
Soda, ...	3·36	0·109	
Loss by ignition, . . .	1·20		
	98·36		

This rock, like the others already discussed, is a compound of quartz and felspar; and it is easy to calculate the proportions of the two minerals as follows:—

	Per cent.
Quartz, ...	20·51
Orthoclase felspar, ...	77·85
	98·36

From the fact, that the felspathic trap of Benaunmore occurs in columnar masses, it may be inferred to be probably of igneous origin: it is massive, fine-grained, with rounded specks of quartz (globuliferous), and small occasional facets of felspar; brittle, of conchoidal fracture, somewhat lamellar, and translucent on the edges, with a ringing clink, and striking fire freely when struck with the hammer.

I have lately had an opportunity, in conjunction with Dr. Wilde of Dublin, of examining a very large number of stone implements found in various parts of Ireland, and I find that the different varieties of siliceo-felspathic rocks were carefully sought out by the makers of these implements. Among the most common varieties so used are the pure pale-green felstone, and a mottled porphyritic variety of the same kind of rock, streaked with pink felspar and dark-coloured metallic hornblende.

In the collection of stone implements preserved in the Museum of the Royal Irish Academy, there are also a number of stone implements from Jamaica, formed of the same kind of felstone, which would appear to have been particularly well suited to the purposes to which such implements are supposed to have been applied.

The felstones and siliceo-felspathic rocks of Ireland are only locally abundant, and as the weapons made from this kind of rock are found in all parts of Ireland, it is conjectured by antiquarians that an extensive trade in, and manufacture of, these felstone celts and weapons must have existed in former times in Ireland. This trade, if such existed, must have been confined to Ireland itself, as there is scarcely a single stone implement in the collection of the Irish Academy which cannot be readily identified as made of an Irish rock; and in many instances the locality from which it was obtained can be assigned with tolerable accuracy.

WEDNESDAY EVENING, JUNE 10, 1857.

EDWARD WRIGHT, LL.D., M.R.I.A., in the Chair.

The following gentlemen were duly elected Members of the Society:—

1. Robert Crawford, Esq., C.E.
2. George Phayre, Esq., C.E.
3. Alexander Tate, Esq., C.E.
4. R. H. Frith, Esq., C.E.

RICHARD GRIFFITH, LL.D., read the following—

LETTER FROM M. ADOLPHE BRONGNIART TO DR. GRIFFITH, ON THE FOSSIL PLANTS WHICH HAVE BEEN DISCOVERED IN THE ROCKS AT THE BASE OF THE CARBONIFEROUS SYSTEM IN IRELAND: COMMUNICATED TO THE SOCIETY BY THE LATTER.

Paris, 5 *Février*, 1857.

MONSIEUR,—J'ai reçu dans le courant du mois de Decembre les échantillons de plantes fossiles que vous avez bien voulu m'addresser, ainsi que les lettres et les dessins qui les accompagnaient. Je les ai immédiatement examinés avec beaucoup d'attention, et je vous prie d'agréer tous mes remerciments pour cet envoi et ces renseignements pleins d'intérêt pour moi.

Je vais vous communiquer le résultat de cet examen, en regrettant qu'il ne me conduise pas à des conclusions positives relativement à la position géologique du terrain, qui renferme ces échantillons.

1°. *Echantillons de Kiltorcan.*

No. 11, 12, 6, 9, 2. Sont tous des échantillons bien mieux conservés et plus complets que ceux que j'avais vus précédemment de la fougère nommée *Cyclopteris** *Hibernica*, et que j'avais cru d'apres les premiers échantillons appartenir au genre *Odontopteris*—ceux ci me font bien

* The fossil above alluded to was referred provisionally to the genus Cyclopteris by the late Professor Edward Forbes, at the Meeting of the British Association held at Belfast in the year 1852.

mieux concevoir qu'ils eussent été classés parmi les *Cyclopteris*, cependant ce n'est nullement le genre naturel qui a reçu ce nom, il n' y'a qu' une analogie dans la nervation—la forme des folioles et leur disposition est bien plutôt celle des *Sphenopteris*, les nervures flabelliformes rapportent cette fougère à ce genre et surtout à la section ou genre nommé *Adiantites* qui a des pinnules entieres, non lobées, ou à peine lobées.

Mais je ne connais aucune espèce réellement voisine de celle ci, et peut-etre devra-t-elle former un genre particulier.

Par son port elle se rapproche du *Sphenopteris lobata* du terrain Permien, mais celle ci a les pinnules profondement divisées. Il y'a encore des recherches à faire sur cette plante, qui est certainement différente de toutes celles que je connais dans les couches carbonifères.

Sur les échantillons No. 12 et 9. Je remarque un caractère rare dans les fougères, quoiqu' il y en ait quelques examples dans les *Neuropteris*, c'est la presence de pinnules naissant directement sur le rachis principal entre les grandes pennes latérales.

La foliole isolée du No. 2 me parait une de ces pinnules.

No. 3, 15, 19, tiges tres remarquables tout à fait nouvelles pour moi, le No. 3 est le mieux conservé et le plus caracterisé il presente deux tiges semblables qui se croisent.

Ce sont bien des tiges quoique tres applaties et ressemblant à des feuilles lineaires, car elles portent des cicatrices d'insertion d'organes appendiculaires tres regulières, disposées en spirale et en quinconce.

L'intervalle des cicatrices est lisse sans cannelure, stries, ni aréoles, comme on le voit dans quelques espèces de Sigillaria figurées dans mon Histoire des Vegetaux Fossiles; mais les cicatrices tres petites ont une forme tres différente, elles representent un petit disque ovale presque rond, dont la surface est finement granulie et sans cicatrice vasculaire bien distincte; il y a cependant un indice d'un faisceau transversal tres vaguement marqué. La tige No. 3 qui n'est pas tres grosse moins d'un pouce en diamètre, presente ces cicatrices en spirale, tres reguliere au nombre de 4 ou 5 sur la demi circonference, soit de 9 environ sur la circonference entiere, et comme la série superieure alterne avec la série inferieure, deux tours de spires doivent comprendre 17 cicatrices, disposition qui se rapporterait à la spire $\frac{2}{17}$, et qui est analogue à cette de certains Lycopodes.

Mais les autres échantillons annoncent des tiges plus grosses. Sur le No. 15, la tige ne parait pas cependant comprendre plus de cicatrices, seulement elles sont plus espacées, quoi que de même dimension chacune, comme cela a bien sur une tige plus vigoreuse oú les feuilles, sans avoir leurs insertions plus grosses, les ont plus espacées.

Le No. 19 presente une tige encore plus grosse et à cicatrices plus nombreuses dans la circonference, environ 7 ou 8 dans une demi circonference.

Je ne connais aucune tige semblable à l'etat fossile, et ne puis la rapporter avec certitude à une famille connue—c'est un des fossiles les plus interessants à rechercher et à tacher de completer.

Ces tiges sont elles simples ou dichotomes? quels sont les organes inseris sur les cicatrices, sont ce des feuilles lineaires comme celles des *Lepidodendron?* les feuilles lineaires contenues dans les mêmes échantillons feraient elles partie de la même plante? Serait ce des raciñes comme les *Stigmaria?* je ne le pense pas, mais il y a beaucoup d'incertitude à ce sujet.

No. 1, 5, 8. Lepidophyllum.

J'ai designé sous ce nom des feuilles qui en général appartiennent aux lepidodendron, mais qui proviennent peut-etre aussi de plantes d'autres genres tels que les *Sigillaria,* ce sont de feuilles lineaires, etroites, uninerviées, et ordinairement carenées.

Celles de ces échantillons presentent ces caracteres, mais aucune n'est assez entiere, pour qu'on puisse apprecier leur longueur totale, et la forme de leur extremité.

Elles ressemblent beaucoup à celles qui paraissent de la tige No. 14, et qui sont representées sur le dessin que vous m'avez envoyé, mais elles sont je crois beaucoup plus longues, et pourraient appartenir aux tiges precedentes.

Dans des feuilles d'une forme aussi simple, il peut y avoir une tres grande analogie entre des organes appartenant à des especes, à des genres, et même à des familles différentes, les différences seraient probablement dans la structure, ainsi actuellement il y a souvent dans les formes seules, une grande analogie entre les feuilles de plusieurs genres différents de conifere, et entre des coniferes et des Lycopodiacées.

La dimension de ces feuilles s'accorderait assez bien avec celle des cicatrices des tiges précédentes, et la forme arrondie de ces cicatrices ne serait pas un obstacle, car on en observe d'assez semblables sur des coniferes à feuilles planes lineaires.

No. 14 cet échantillon joint au beau dessin que vous m'avez addressé de la part du Professeur Haughton, donne une idée assez complette de cette plante remarquable.

La forme générale, celle des feuilles, et la disposition de ces organes sur la tige est celle des Lepidodendron. Mais les cicatrices d'insertion de ces feuilles, telles que je puis les observer sur une partie de l'échantillon No. 14, différent beaucoup de la forme ordinaire de celles des Lepidodendron.

Cependant en considérant qu'elles correspondent à des rameaux jeunes, encore couverts de leur feuilles, et ne sont pas de vraies cicatrices laissées sur la tige apres la chute des feuilles, on peut je crois regarder cette plante comme appartenant au grand genre Lepidodendron.

La différence entre les insertions des feuilles par les jeunes rameaux, les cicatrices des feuilles récemment tombées sur des rameaux plus agés, èt celles des grosses tiges est tres grande, comme on le voit par les espèces abondantes dans certains terrains houillers.

Les feuilles resemblent beaucoup à celles des No. 1, 5, 8, mais elles sont beaucoup moins longues, et un peu plus étroites.

Je ne pense pas que ce puissent etre des rameaux du *Lepidodendron minutum*, dont les cicatrices paraissent plus courtes et plus rhomboidales. Je crois qu'on doit en faire une espèce speciale que je vous demande la permission d'appeler *Lepidodendron Griffiithii.**

J'ai un échantillon d'Ecosse de *Burdie-house*, qui se rapproche plus qu' aucun autre de cette plante, mais les feuilles sont tombées, et la forme des cicatrices un peu différente.

Le dessin d'un fragment de *Lepidodendron minutum*, que comprend

* The fossil above named was discovered by Dr. Carte, and is in the Museum of the Royal Dublin Society, as are also all those from Kiltorcan, under the several Nos. referred to: specimens of which, bearing similar numbers, are in the possession of M. Brongniart.

le grand dessin de M. Haughton, ne suffit pas pour déterminer les formes précises de cette espèce, et ce serait un de mes principaux desiderata d'avoir un bon échantillon de cette plante, dont les caractères fussent bien appreciables.

Les échantillons No. 4, 7, 17, 18, renferment des sortes de tiges sans aucunes cicatrices, qui paraissent avoir été epaisses et cylindriques et lisses à leur surface. Je presume que ce sont des petioles de fougères, et probablement d'apres leur grosseur du Sphenopteris Hibernica.

Dans les échantillons 1 et 10, il y a dans chacun un fragment de feuilles larges lineaires striées, qui paraissent analogues à cette du *Nöggerathia* ou *Pychnophyllum* (*Flabellaria borassifolia*, Sternb.) mais ils sont trop imparfaits pour avoir une opinion positive à leur egard.

Le No. 16 m'est tout à fait inconnu, et sa nature est tres difficile à apprecier—serait ce un rhizome comprimé de fougère?

Je n'ose avoir aucune opinion sur un seul échantillon, qui offre aussi peu de caractères particuliers.

Cette revue des échantillons de Kiltorcan est, comme on le voit, tres peu propre à décider la question de la nature Devonienne ou carbonifere de ce terrain.

Specifiquement ces plantes sont différentes de celles du terrain carbonifere. Génériquement elles rentrent dans la même nature de vegetation; mais c'est aussi ce qui parait avoir lieu pour le petit nombre d'espèces connues du terrain Devonien.

Il parait qu'on a trouvé, il y a deux ans, en Allemagne à Saalfield en Thuringe un gisement de plantes fossiles Devoniennes, mais M. Unger qui a annoncé ce fait, n'a pas encore, que je sache, decrit et figuré ces plantes; il en a seulement donné une liste dans le Bulletin de l'Académie des sciences de Vienne, et comme presque toutes sont d'apres lui nouvelles, il est impossible de les comparer avec vos plantes d'Irlande, il faut attendre pour resoudre cette question intéressante: mais il serait à désirer que vous puissiez réunir le plus grande nombre possible d'échantillons de ce terrain, et surtout de cette localité de Kiltorcan, qui les presente dans un bon etat de conservation.

Je serai toujours à votre disposition pour les etudier, et les comparer avec ceux d'autres localités, que j'ai réuni dans les collections du museum de Paris.

J'ajouterai quelques mots relatifs aux échantillons des autres localités.

1°. *Tallow Bridge.*

Ces échantillons sont si imparfaits, qu'il est bien difficile de se former une opinion à leur egard.

Je doute beaucoup que le *Sigillaria dichotoma* soit une vraie *Sigillaria*, l'écorce manque partout, ainsi que des cicatrices nettes, c'est seulement le moule de l'axe ligneux, ou de la partie sous-corticale, et je croirais plutôt qu'il appartient à un *Lepidodendron*, dont les vieilles tiges dépouillées de leur partie corticale presentent souvent le même aspect.

Ce serait peut etre les tiges de la même plante dont le *Lepidodendron minutum** No. 3 serait les rameaux, le No. 4 presente une dimension et une forme intermediaire.

2°. *Environs de Ballycastle.*

1. Fragments indéterminables, l'étiquette porte '*ferns*' mais je n'en vois pas de traces.

2. Doonadoba.—Portion de fronde dichotome resemblant beaucoup au *Fucoides antiquus* des terrains de transition de Norvège. Je doute cependant qu' il y ait identité, la forme est un peu différente et on y remarque la trace d'une nervure mediane qui manque dans ce *Fucoides*.

3 et 4. Indéterminables.

5. Tissu ligneux assez bien conservé d'une dicotyledone gymnosperme conifere? ou peut-etre sigillarée? les fibres au microscope paraissent rayées.

3°. *Killaghtee.*

1 et 2. Rien d'appreciable.

3. *Stigmaria ficoides*—échantillon tres imparfait mais certainement de ce genre.

Je voudrais pouvoir me former une opinion exacte, des diverses sortes de tiges representées sur le beau dessin de M. Haughton avec le grand *Lepidodendron*, mais les dessins les plus parfaits laissent toujours des points d'organization obscurs, car on ne peut pas y appliquer la loupe pour en juger les détails, des echantillons de ces diverses tiges auraient pour moi beaucoup d'intéret. Je remarque seulement que la Fig. 2

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* This fossil was described and figured in a former Number of this Journal.

indiquée comme *Sigillaria dichotoma* diffère beaucoup des échantillons de Tallow Bridge envoyés sur ce nom, et ressemble d'avantage aux tiges No. 3, 15, 19 ci dessus décrites, seulement les cicatrices sont figurées en lignes transversales, et non pas en lignes obliques.

Le dessin de tige* avec des racines en *Stigmaria* m'a font grand plaisir, c'est une nouvelle confirmation des faits déjà observées qui etablissent que les stigmaria ne sont que des racines de grand végétaux arborescents, qu'on a généralement reconnus pour des Sigillaria,—il est à regretter qu'ici la tige ne soit pas conservée, dans une étendue suffisante pour que la forme de sa surface puisse etre etudiée : si on en retrouvait de semblables, il serait bien à désirer qu'on peut recueillir une portion de la surface de la tige, et un morceau des racines, en choisissant les parties les mieux conservées.

Je vous renouvelle Monsieur, en terminant cette longue lettre, l'assurance de l'intéret avec lequel je recevrai toutes les communications, que vous voudrez bien me faire relativement à vos plantes fossiles, et des efforts que je ferai pour vous addresser quelques renseignements satisfaisants à leur egard.

Je regrette beaucoup d'avoir dans le cas actuel été obligé d'exprimer plus souvent des doutes que des affirmations; le sujet est si difficile, et nos moyens d'investigation si imparfaits, que cela me servir à d'excuse.

Veuillez agréer Monsieur l'expression de mes sentiments les plus distingués.

AD. BRONGNIART.

P. S. Veuillez avoir la bonté d'exprimer à M. Haughton tous mes remerciments, pour le beau dessin qu' il m'a addressé, et que je conserverai precieusement.

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* The fossil referred to by M. Brongniart was obtained in the gray sandstone at Mac Swyne's Bay, near Dunkineely, in the county of Donegal, and is at present in the court-yard of the Royal Dublin Society; and a translation of this communication was read before that Society in connexion with a paper on the Plants of the Yellow Sandstone, by Mr. Griffith, on March 27, 1857.

Dr. Griffith then read the following—

EXPLANATION OF THE PRINCIPLE OF COLOURING, AS WELL AS OF REFERENCE TO THE COMPOSITION OF ROCKS BY LETTERS CONTAINED IN THE TABLE APPENDED TO THE LAST EDITION OF THE "GEOLOGICAL MAP OF IRELAND;" TOGETHER WITH THE ORIGINAL NOTES MADE IN THE YEAR 1847, RELATIVE TO THE COMPOSITION AND STRUCTURE OF ARKLOW ROCK AND OTHER IGNEOUS PROTRUSIONS OF THE COUNTIES OF WICKLOW AND WEXFORD.

In preparing the last edition of my "Geological Map of Ireland," dated April, 1855, I appended a Table explanatory of the colours and letters adopted by me to indicate the character and composition of the several rocks which occur throughout the country, as far as my examination enabled me to do so; but as it would appear from several sheets of the Government Geological Survey of Ireland, lately published, on the scale of one inch to a mile, that differences occur in the views entertained by my friend Mr. Jukes and myself, in regard to certain portions of the numerous insulated patches of rock of an igneous character, which occur in certain continuous lines or chains throughout the lower Silurian schistose district of the counties of Wicklow, Wexford, and Waterford, I think it desirable at the present time to explain to the Society what is intended to be represented by the shades of red and purple which distinguish those patches from the general tint of gray, which indicates the position of the strata belonging to the lower Silurian period.

The different districts and insulated patches throughout Ireland which are tinted with carmine indicate the areas which, in my opinion, should be classed as granite; and the difference in the composition and ages of those rocks in different localities are shown by the letter U, and its adjuncts, as Ua, Ub, &c. The igneous protrusions, whether in the form of mountain masses, hummocks, bosses, or dykes, composed essentially of the minerals felspar and hornblende (the latter usually predominating), generally known by the name of greenstone and greenstone porphyry, are represented by a shade of deep-red and their varieties, by the letter X and its adjuncts, as Xa, Xb, Xf, &c.; while the several protruded masses composed chiefly of felspar, with occasional hornblende and quartz, varying from sub-crystalline to compact (for one variety of the latter of which (Xd) I have adopted Kirwan's term 'felsite' in my map), and which in Wicklow, Wexford, &c., are frequently associated with protruded greenstones and greenstone porphyries, are distinguished from them by the letters, though not by colour; but it should be mentioned that, partly owing to the smallness of the scale, four miles to one inch, on which my Geological Map has been published, and partly from want of sufficient leisure to make in detail all the necessary observations, I have been unable to distinguish on the Map numerous comparatively small ramifications, whether of the compact felspathic rock or of greenstone, which occur in the rocks which adjoin the great protrusions of compact felspathic rock or of greenstone; hence all such have merged in the general purple tint, lettered Ya, Yb, Yc, Yd, Yf, &c., which indicates the rocks that, as a class, I have included under the term "metamorphic."

My opinion, when the examination of the districts was made, being that many of the more minute strings or irregular beds of imperfectly developed felspathic porphyry, or even hornblendic rocks, originated in the fusion or semi-fusion of a portion of the original schistose rock, during the period of igneous action, when the great protrusions of the greenstone and felspathic rocks took place; and it is solely in regard to the origin and nomenclature of a portion of the rocks tinted purple on my Map, in which any important difference occurs between my views as given on the Geological Map, and those of the Government geological surveyors as represented on their maps; and my opinions and doubts on this subject are contained in my original notes, written in the year 1847, relating to Arklow Rock, and the igneous protrusions of the country generally; and, indeed, at the present time, I entertain the same doubts of the propriety of classing and uniting certain sub-crystalline felspathic rocks with metamorphic strata. But still I apprehend, that too great an extension may be given by the geological surveyors to a class of rocks called *volcanic ash*, conceived by them to have been deposited contemporaneously with the formation of the rocks of the Silurian period,—as I possess many specimens of apparently schistose rocks collected within the limits of these tracts of volcanic ash, which appear to me to exhibit decided indications of a sedimentary arrangement, though altered in external appearance, and presenting the ordinary character of metamorphic schist; and it was this circumstance which induced me to describe the districts referred to as metamorphic; many of which cannot be distinguished from the admitted metamorphic schist which occurs in the vicinity of the granite boundaries of the counties of Wicklow and Wexford.

This is a subject well worthy of discussion in the field, where alone a satisfactory conclusion can be arrived at. We are all searching for truth, to arrive at which we have only to observe with care, and decide without prejudice.

In illustration of the foregoing observations I may mention, that during the last month (May), while looking over the rock specimens collected in the counties of Wicklow and Wexford during my last hasty geological examination of those counties just ten years ago, and also consulting my note-book, as well as the observations laid down on the Ordnance Maps, for the purpose of refreshing my memory preparatory to accompanying my friends, Mr. Jukes and Professor Haughton, on a contemplated excursion to a portion of that district,—I discovered, among other matters, a short note of my views relating to the composition and structure of Arklow Rock, with the opinions I entertained at the time respecting the igneous origin of the white felspathic rock, so prevalent in the counties of Wicklow, Wexford, and Waterford, called by me *compact felspar*, but to which Professor Sedgwick's appropriate name of felstone has lately been applied by Mr. Jukes.

In the present state of the geological examination of the country, I think it desirable, however crude, to bring these notes, as made on the spot, before the Society, with a view to future discussion.

In the last edition of my Geological Map of Ireland I have not made any change in the divisions which, in 1847, I thought it best to adopt between the rocks which I believed to be undoubtedly of igneous origin, and those which presented a kind of mean between igneous and schistose metamorphic rocks, the greater portion of which are now classed by the geological surveyors as *volcanic ash*. And, although I do not mean on the present occasion to dispute this view, still, on looking over my notes and specimens, I am not yet quite a convert to it, at least to the full extent of the views entertained by Mr. Jukes, and his excellent corps of field observers.

The following are the notes written at Arklow, dated June 26, 1847:—

The most satisfactory and characteristic example of the igneous protrusions of the counties of Wicklow and Wexford is exhibited at the hills called generally *Arklow Rock*, situate about two miles to the south of the town of Arklow. At this place there are two abrupt hills which rise precipitously, one out of the sea on the east side, and the other from the schistose plain on the west.

If we commence our examination from the south-western point of the western hill called Rock Little, we find a remarkable though irregular vein of white or grayish-white porphyritic felspathic rock, traversing the slate rock in a north-east and south-west direction, where it crosses the road at the south end of Rock Little, and where it has been quarried; its breadth is about 80 feet, having metamorphic schist on the west side, and a protrusion of greenstone on the east: proceeding northwards, the vein expands, and is there quarried extensively, and when broken is used for repairing the roads. In some places the rock includes thick elongated masses of schist, which are highly metamorphic, and sometimes present the character of semi-porphyry.

About 300 feet northward from the first opening of the vein at the road, it presents the appearance of three distinct veins, each having vertical sides, separated from each other by interposed masses of metamorphic schist, which are stratified horizontally, and have a vertical cleavage. If in this place we make a section across the vein from west to east, we find first a vertical vein consisting of white felspathic rock, having a porphyritic structure, from its containing occasionally imperfect crystals of felspar, a few crystals of hornblende, and grains of gray quartz; this vein or branch is 16 feet in breadth; beyond it to the east is a rib of metamorphic schist, presenting the usual cleavage 14 feet broad; then a second vein of felspathic rock, similar to the first, 50 feet in breadth, again a second mass of metamorphic schist, 70 feet broad, beyond which is a vein of coarse-grained felspathic rock, 70 feet broad at the least, but to the north-eastward it may be considerably more; this rock in hand specimens presents the appearance and structure of a rather fine-grained granite, being composed of grayish-white felspar, white mica, some crystals of hornblende, and some quartz; the blocks which have been quarried present large cubical or rather slightly rhomboidal masses, many of which would weigh upwards of a ton, some upwards of two tons. Notwithstanding the difference in the structure, it is probable that the three apparently distinct veins are the produce of one common root, and that the difference in the veins has resulted from the slower cooling of the large mass giving time before consolidation for the more perfect development of the crystals of felspar, &c.

Continuing our general section to the eastward, we find schistose rock dipping to the south-east, at an angle of 15 degrees, having a nearly vertical cleavage; it is highly metamorphic near its contact with the felspathic vein, but becomes gradually less so at a distance from it.

Continuing the section to the east, at a distance of about 200 feet from the last-mentioned granular branch of the felspathic vein, we come in contact with and cross the direction of the greenstone protrusion already mentioned, which at the road forms the eastern boundary of the felspathic vein, but which, taking a north-easterly course, cuts obliquely across the strike of the schistose rock. This greenstone continues in the same direction, forming the summit and eastern declivity of the hill of Rock Little. But before reaching the farm-house of Rock Little it descends into the earth and is lost.

At the house of Rock Little, unaltered schistose rocks are visible, dipping south-east at angles varying from 10 to 20 degrees, and I have no doubt that this schistose rock forms the base of the valley which intervenes between Rock Little and Rock Big.

The protruded mass of greenstone just mentioned is highly crystalline; it is composed of oblong crystals of white felspar, with a profusion of imperfect crystals of black shining hornblende, forming a very hard and beautiful rock.

At the forge which stands at the forking of the road at the southern end of the valley, between Rock Little and Rock Big, is a second protrusion of greenstone, which extends uninterruptedly along the line of the old Arklow road, in a north-easterly direction to the sea below the graveyard. This rock is not so coarse-grained as that first described; the felspar is visible, but crystals of hornblende are rarely fully developed. Ascending Rock Big to the eastward, we find a close-grained felspathic mass, similar to that which occurs in the protrusion already mentioned; but in this case it presents a rude columnar structure, the columns being four, five, or six-sided, inclining towards the N. E. at an angle of about 30°. Still continuing to ascend Rock Big to the eastward, the rock graduates into rather coarse-grained greenstone, the crystals of felspar and hornblende being tolerably well developed, but not so perfectly as that first-mentioned. Still continuing to ascend, the crystalline and unstratified rock presents a nearly horizontal tabular structure, and the different tables exhibit different characters: in some it is felspathic bluish-gray, with crystals of hornblende, in others, dark bluish-gray, compact or splintery felspar without quartz. At the summit the rock is composed of a base of dark-gray compact felspar, with disseminated imperfect crystals of white felspar. Descending the declivity to the eastward, the base of the rock still preserves its dark-gray colour, but it becomes very fine-grained, and presents the character of clinkstone porphyry, being translucent at the edges.

This rock has been much quarried; it very much resembles the felspathic porphyry of Penmonmawr in Carnarvonshire, used for the pavement of London. Continuing to descend to the eastward, the same rock continues to the base of the steep declivity, where the surface rock presents a white colour, and is similar to that of the vein first-mentioned, but on this mass being quarried beyond the weathered surface, it presents the dark bluish-gray colour of the sub-crystalline felspar porphyry of the summit of the hill. Still continuing to descend to the eastward, the rock, which presents a white felspathic mass at the surface, is followed by dark bluish-gray compact felspathic porphyry, which extends nearly to the coast.

The cliff immediately above the strand is composed of a brown and apparently irregularly stratified mass of rock, dipping S. W., angle 80°, and presents a very doubtful character. At the base close to the shore, near the old mine adit, the rock consists of thin beds of black Lydian stone, passing into flint slate, in which graptolites have been discovered. At the adit a bed of breccia occurs, having a close-grained quartzose or hornstone base, with angular fragments of white quartz and some Lydian stone; but time did not admit of these rocks being examined with sufficient care. Leaving the section, and proceeding in a N. E. direction towards Arklow and the sea, we find that the greenstone and columnar felspathic rock extend uninterruptedly from the forge in a north-easterly direction to the sea-shore, at the northern extremity of

Rock Big, varying frequently from ordinary greenstone to the dark gray compact felspathic rock. On the sea-shore there is a rude façade of basaltic columns similar to, but more perfect than, those already mentioned, which are being quarried for the pier at Arklow; and the columnar structure is in consequence far less striking than it has formerly been, but it is still sufficiently visible. The most remarkable circumstance is, that these columns sometimes consist of a porphyritic felspathic rock, composed of dark-gray compact felspar, containing imperfect crystals of hornblende; while other portions of the mass are composed of splintery, fine-grained, dark-gray compact felspar, having a conchoidal fracture, translucent at the edges, and in hand specimens resembling fine-grained quartzite.

The coast south of this columnar rock is composed of the ordinary amorphous unstratified rock, varying in character and colour, as already mentioned; but it is remarkable that the dark-gray rock is in one instance at least traversed by a vertical vein of white compact felspar rock about 9 inches in thickness, exactly similar in structure to that first described.

On the whole, Arklow Rock consisting of Hills Big and Little, presents a fine example of an igneous protrusion, or perhaps succession of protrusions through the slate rocks; and the frequent variation in the structure and composition of the rock in different parts proves that similar rocks which occur in various parts of Wicklow and Wexford, intermixed with slate rock, are also igneous protrusions, though in many cases, owing to their ambiguous character and schistose structure, I have classed them with, and called them, metamorphic slates.

The quarry at Gorey may be instanced as an example, also Ask Hill, north of Gorey, where the porphyry and felspathic rocks are associated with greenstone, similar to that on Rock Little.

On the whole, the results of the examination of Arklow Rock leave no doubt on my mind as to the igneous origin of Tara Hill, and other hills and ridges of that district; but still there are several localities in which both porphyritic and felspathic rocks occur, so intimately associated with rock presenting a schistose structure as to render it doubtful whether they should be classed with igneous or with schistose metamorphic rocks, and I may mention Bennogue Hill, near Gorey, as an example.

Mr. Joseph Kincaid, Jun., exhibited, and read the following remarks on,—

A SECTION ACROSS THE COAL BEDS OF LEITRIM.

The paper which I have the honour to lay before the Society has reference to a section made through the Coal district of the county of Leitrim. It was taken in a direction nearly north and south across Lough Allen. The beds south of that Lake are almost horizontal, and north dip about 10°. Starting from the hills above the Crevylea Company's Iron Works, near the small Lake Lackagh, we pass over the red and white sandstone, or freestone, in which occur thin seams of coal. These were formerly worked, but have been abandoned for some time. Descending then by the river that runs by the Company's furnaces, we have exposed a thick bed of shale, in which are the workings for ironstone. This is found in balls, and in the bed, the former uppermost, about five or six feet thick, and of great richness, and the latter immediately below, not so rich, but also very valuable. Beneath this, at the furnaces, occurs a seam of excellent fire-clay, which lies at the bottom of the shale. It is from eighteen inches to five feet thick, and the specimens of alum are from this seam. I also found some well-preserved Orthoceratites in the limestone nodules that surrounded this. These nodules are formed of thin coats or layers, and are generally of large size; but those I was able to split open generally contained these fossils. Below this occurs an impure limestone, called Calp,—this being, I suppose, a mere lithological distinction. In this I found many traces of Posidonomya.

Further to the west we come upon the limestone that is worked for the Company's furnaces. This is very hard and compact, and contains few fossils. I was only able to obtain a few small specimens of Atrypa.

On the other side of Lough Allen we again come upon the impure limestone, dipping in the same direction. This would seem to indicate a considerable fault in the Lake,—one, I should think, of six or seven hundred feet.

I have now to point out the principal peculiarity in the section, which is the occurrence here of a bed of gypsum, about five or six feet thick. It is of peculiar appearance, being thickly interspersed with crystals of Selenite, and lies on the impure limestone at the edge of the Lake. I do not know that the occurrence of a bed of gypsum in carbonate of lime has been noticed before; but Professor Jukes informs me that he has seen fossils converted into sulphate of lime, and full of Selenite, imbedded in the tertiary limestone of South Australia, and also in the recent limestone of the coral reefs.

The remainder of the section shows the shale, which is about 120 feet thick, and the sandstone which contains the seams of coal worked by the Crevylea Company for their Iron Works. The seat-rock, which corresponds with the under-clay of the English coal-measures, is here a hard, fine-grained sandstone.